BEING FOR NATURE:

EXPLORING THE DESIGN OF PEDAGOGICAL GREENSPACES TO SUPPORT CHILDREN'S CONNECTION TO NATURE IN THE URBAN CONTEXT

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Give them the fields and the woods and the possibility of the world salvaged from the lords of profit. Stand them in the stream, head them upstream, rejoice as they learn to love this green space they live in, its sticks and leaves and then the silent beautiful blossoms.

Attention is the beginning of devotion.

- Mary Oliver

Photo taken during the case study on a class trip to a nearby lake.
Abigail Garbett, October, 2019.

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ABSTRACT

Children today are born into a complex and contradictory world of entwined social and ecological problems with increasing levels of uncertainty. As the number of plant and animal species plummets in what scientists describe as the sixth mass extinction, the flow of people to urban areas continues to rise. Simultaneously, the decline of children's routine experience of nature is widely reported with direct impacts on health, wellbeing and the development of positive environmental attitudes. In the nexus of these interrelated problems lies an opportunity for urban design which promotes both ecosystem and human flourishing. The purpose of this thesis is to critically examine how the design of pedagogical green spaces, namely school yards and urban parks can enhance children's connection to nature.

For the main research component, I conducted a five-week observational study of three outdoor schools/preschools in Stockholm. The purpose of the study was to record the relation between the qualities of various significant nature situations and the physical properties of the spaces that they occurred within. The results suggest that it is possible to determine which physical elements are frequently part of significant nature situations. By including these elements within the design of pedagogical greenspaces, it is likely that a high potential for nature connection could be provided. Furthermore, the results show the qualities of significant nature situations can be divided into 5 key categories: restorative experiences, creative experiences, sensory experiences, physical free play and nature school which were recorded alongside the physical properties present in each situation. The results show that the first four categories are linked to specific physical attributes while nature school activities utilised a combination of different properties. Consequently, there is a potential to design greenspaces which support specific types of nature situations.

The results can be utilised by urban planners and designers as a guide for designing and evaluating pedagogical greenspaces based on the development of different types of significant nature situations. An important implication of the study is the finding that many of the physical properties that enhance the likelihood of human nature connection, occur within healthy ecosystems and as such is a powerful motivator for development of urban greenspaces that simultaneously enhance ecosystem resilience with human health and wellbeing.

KEYWORDS

Human-nature connection, Urban planning, Regenerative design, Social-ecological urbanism, Urban greenspace

SAMMANFATTNING

Barn föds idag in i en komplex och motsägelsefull värld av sammanflätade sociala och ekologiska problem med ökande nivåer av osäkerhet. Medan antalet växt- och djurarter minskar dramatiskt i vad forskare kallar den sjätte massutrotningen fortsätter flödet av människor till urbana områden att öka. Samtidigt rapporteras det ofta om minskningen av barns regelbundna erfarenhet av naturen med direkta konsekvenser för hälsa, välmående och utvecklingen av positiva attityder gällande miljö. I kedjan mellan dessa sammanlänkade problem ligger en möjlighet för urban design som främjar både ekosystems och människors välmående. Syftet med denna uppsats är att kritiskt undersöka hur utformningen av pedagogiska grönområden, i detta fall skolgårdar och stadsparker, kan stärka barns anknytning till naturen.

Den huvudsakliga forskningsdelen bestod i att jag genomförde en fem veckor lång observationsstudie på tre utomhus skolor/förskolor i Stockholm. Syftet med studien var att dokumentera relationen mellan egenskaperna hos olika signifikanta natursituationer och de fysiska egenskaper hos platserna där de tog plats. Resultaten tyder på att det är möjligt att avgöra vilka fysiska komponenter som ofta förekommer vid signifikanta natursituationer. Genom att inkludera dessa komponenter i utformningen av pedagogiska grönområden är det troligt att en ökad potential för anknytning till naturen kan skapas. Dessutom visar resultaten att egenskaperna hos de signifikanta natursituatinerna kan delas upp i 5 huvudkategorier: restorativa upplevelser, kreativa upplevelser, sensoriska upplevelser, fysisk fri lek och naturskola vilka dokumenterades tillsammans med de fysiska egenskaperna som var närvarande vid varje situation. Resultaten visar att de fyra första kategorierna är bundna till specifika fysiska attribut medan naturskole-aktiviteter använde en kombination av olika egenskaper. Således är det möjligt att utforma grönområden som gynnar specifika typer av natursituationer.

Resultaten kan användas av stadsplanerare och designers som en vägledning för att utforma och utvärdera pedagogiska grönområden utifrån utvecklingen av olika typer av signifikanta natursituationer. Ett viktigt resultat av studien är upptäckten att många av de fysiska egenskaper som ökar sannolikheten för människors anknytning till naturen förekommer i välmående ekosystem vilket är en stark motivation för utvecklingen av urbana grönområden som samtidigt stärker både ekosystemens resiliens och människors hälsa och välmående.

NYCKELORD
Människa-natur anknytning, Stadsplanering, Regenerativ design, Socio-ekologisk urbanism, Urbana grönområden

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1 INTRODUCTION

The motivation for this thesis lies in the widespread evidence that routine experience of nature has significantly declined over the past few decades in a phenomenon often referred to as the 'extinction of experience' (Pyle, 2011). The phenomenon is concerned with a progressive loss of engagement with a multiplicity of human-nature experiences, including but not limited to interaction with wilderness or 'pristine' nature, urban parks, allotments and planted vegetation (Soga & Gaston, 2016). Everyday activities, such as passing time in nearby greenspaces and observing wildlife, are in decline. The effects are particularly felt by children born in the twenty-first century who generally have less freedom to roam and explore nature than their parents' generation (Bratman et al., 2012, p. 119).

The causes of the current extinction of experience have been attributed to an increase in urban living, sedentary pastimes and the micromanaging of children's lives, particularly in more industrially developed nations (Shaw et al., 2013; Soga & Gaston, 2016). Children growing up in contemporary urban paradigms navigate increasingly dense and technology-centred living environments where the rich multisensory experience of diverse landscapes are often replaced by two-dimensional, digital realities (Soga & Gaston, 2016).

In the past decade, an increasing number of studies have been conducted to understand how this global phenomenon impacts child development (Azlina & S., 2012; Karsten, 2005; Kyttä et al., 2018; Roberts & Foehr, 2008). Key findings suggest that the consequences include a deterioration in health and wellbeing and an implicit disaffection towards nature, resulting in a decline in environmental behaviour and awareness in later life (Bratman et al., 2012; Carrus et al., 2015; Keniger et al., 2013; Nisbet et al., 2009; Soga & Gaston, 2016; Zylstra et al., 2014)

The term 'human-nature connection' (HNC) suggested in Ives et al. (2017) is used to describe "systems of meaningful relationships between mind, body, culture, and environment that can promote [...] sustainable living." (Giusti, 2019, p. 19). In this thesis I investigate the HNC that children develop in relation to the physical space they use during school and preschool activities. The goal is to explore how the spatial configuration of pedagogical greenspaces, such as school yards and surrounding natural areas, can enhance children's HNC. The role of design research from this perspective can be considered as a 'research into design' which involves observation of an existing design phenomenon, namely urban pedagogical greenspaces (Feast & Melles, 2010).

The starting point for this thesis was to explore the emerging concept of the 'social-ecological city' which is used by Samuelsson et al. to describe an emerging narrative in urban development based on the potential for urban

environments to mutually benefit ecosystem integrity and human health (2018). As such, the design of social-ecological cities can be considered to be a form of 'spatio-social innovation' which focuses on the conditions of human settlements and their communities (Ceschin & Gaziulusoy, 2016, p. 120) and 'regenerative design' which focuses on community planning and building design based on the co-evolution of human and natural systems (Cole, 2012).

1.1 RESEARCH GAP

In academic research, the topic of human nature connection (HNC) has seen a dramatic increase since 2010 and has been studied across several disciplines, in various forms and with differing epistemological perspectives (Ives et al., 2017). Significant research from the fields of psychology, environmental studies, urban planning and sustainability sciences point to the importance of HNC for human health and wellbeing (Bratman et al., 2012; Folke et al., 2016; Keniger et al., 2013; Soga & Gaston, 2016).

From this literature, it is clear that time and access to nature, particularly in childhood, are important factors in the development of a meaningful connection to nature. However, there lacks a degree of clarity over the conditions and activities that best promote such a connection (Bruni et al., 2017; Giusti, 2019; Ives et al., 2017; Soga & Gaston, 2016). In particular, there is a gap in knowledge of the spatial and environmental attributes that enable connecting nature experiences for children (Ives et al., 2017). Understanding this relationship is important as without knowledge of spatial and environmental attributes, nature-connecting environments cannot be conceived or designed.

1.2 RESEARCH AIM AND QUESTIONS

The aim of this thesis is to explore how the spatial configuration of pedagogical green spaces, such as school yards and parks, can enhance children's HNC. The overarching research question is:

> How can we better design pedagogical greenspace to support children's connection to nature in the urban context?

In order to understand this, I will explore the following sub themes:

CRITERIA AND CONSTRAINTS

- What are the physical attributes of outdoor spaces that nurture children's connection to nature?
- What are the limiting factors?

OPPORTUNITIES AND IMPACTS

- What are the implications of well-designed pedagogical greenspaces for children and ecosystem health?

2 BACKGROUND

2.1 TERMINOLOGY

The subject of human-nature connection and interaction is rich with various interpretations and layers of meaning. In order to guide the reader, I have defined the following terms which are frequently used in this research.

2.1.1 NATURE

In his seminal text, 'Keywords. A vocabulary of culture and society', Raymond Williams argued that the term 'nature' is one of the most complex words in the English language owing to the fact that it has variable meanings that often contradict each other (1985, p. 219). According to Williams, there are three general areas of meaning for the word. First, the 'essential quality and character of something', second 'the inherent force' responsible for the direction of the world or human beings or both and third, 'the material world itself' which may or not include human beings (Ibid., p. 219).

In the context of this thesis I will use the term nature in the third sense, relating to the material world which does not directly include human activity. However, I acknowledge that in the broadest sense, humanity and all the materials, places and cultures we have created have an environmental foundation which could be called nature (Giblett, 2012).

In an attempt to avoid overly romanticising nature, I refer to the nature of 'everyday life' which is a mix of human and ecological influences rather than 'untouched nature'. This is in line with how the concept of nature is considered in HNC literature; 'places, landscapes and ecosystems that are not completely dominated by people' in both the urban and rural context (Ives et al., 2017, p. 106).

2.1.2 PEDAGOGICAL GREENSPACE

The term 'pedagogical greenspace' is used to refer to public green space, such as schoolyards and public parks, that are used for pedagogical activities with children. The term acknowledges that spaces traditionally considered as outdoor 'play areas' may also be used for educational purposes, for example during outdoor school lessons or supervised activities. The term also recognises that play is central to the way children learn and that outdoor play has intrinsic educational possibilities.

2.1.3 HUMAN-NATURE CONNECTION (HNC)

The term 'human-nature connection' (HNC), as suggested in Ives et al. (2017) is used to describe "systems of meaningful relationships between mind, body, culture, and environment that can promote [...] sustainable living." (Giusti, 2019, p. 19). Theoretically, this thesis is based on an understanding

of HNC as an embodied construct as outlined by Raymond et al. (2018).

This embodied approach recognises the importance of place and considers children's HNC a set of abilities that children can learn given the correct cultural and spatial circumstances (Giusti et al., 2018). It brings together cognitive and affective factors (such as perception of nature and feelings towards nature) with contextual factors including bodily experience, culture and geographical location (ibid). The importance of combining experiential, psychological, and contextual dimensions in the analysis of HNC has also been remarked on in other empirical studies which assess children's human-nature relationships (Giusti, 2019).

2.1.4 SIGNIFICANT NATURE SITUATION (SNS)

The term 'Significant Nature Situation' (SNS) is used here to describe meaningful outdoor experiences that have the potential to connect people to nature in the widest sense (Giusti et al., 2018). This includes a multitude of physical, sensory, creative and restorative experiences such as climbing a tree, drawing outdoors, digging in mud or foraging for wild berries.

The term SNS is used to be consistent with existing research on where and how people connect to nature and is a central component of the theoretical framework on which the case study of this thesis is built.

2.2 THE SWEDISH CONTEXT

Connection to nature is deeply rooted in the cultural heritage of Sweden. As a land mass, Sweden is one of the most forested countries in Europe with tree-cover over more than half of the surface area (Szczepanski, 2001). For Swedish people, the forest and connecting natural resources have been a source of income, shelter and spiritual sanctuary for centuries. Although today the majority of the population live in urban environments, the self-image of Sweden as a nature-loving country remains.

This self-image is reflected in the historic law of 'Allemansrätten' (translated as 'every-ones-right') which allows people to roam freely even on private property and the Swedish/Norwegian tradition of 'frilutftsliv' (Gelter, 2000). Friluftsliv is a multi-faceted concept which roughly translates as a 'free air life'. It describes in practical terms the experience of nature-based outdoor recreation (Beery, 2013) and more philosophically, the feeling and experience of a deep connection with the landscape and a nature-based lifestyle (Gelter, 2000).

In an attempt to preserve the natural landscape during Sweden's second industrial revolution, national parks and reserves were created by the Nature Protection Act in 1909 (Szczepanski, 2001). The protection of national parks and reserves continues today and has special importance for outdoor education and recreational activities within and outside urban areas. Roughly half of the 1, 350 nature reserves in Sweden have been created for recreational use and recreational activities can be carried out without any special permission or consideration of other land uses (ibid).

However, there are concerns about the overuse and disturbance created by visitors. The term 'recreational capacity' is used to describe 'nature's ability to provide outdoor pleasure' in areas of frequent use (ibid, p.19).

The context of Stockholm, was chosen for this study due to its strong tradition of urban nature conservation and ecosystems management. In 1972, Stockholm hosted the first UN Environment and Development Conference and in 2010, Stockholm was awarded the first European Green Capital award, in recognition of the city's sustainable activities and commitment to environmental protection (Kaczorowska, 2014, p. 1).

Within the municipality of Stockholm there are multiple urban parks and nature reserves created to preserve biodiversity and/or to meet recreational needs. There also exists many self-organised as well as government led projects taking place in the city including urban gardening, innovative urban planning and alternative nature-based education.

Stockholm based, 'I Ur och Skur' (translated as 'In rain and shine') outdoor schools were selected as the focus of this research due to their pedagogical emphasis on outdoor education and aim to develop children's knowledge and 'feeling' for nature through outdoor experiences.

Fig. 1 & 2

Example of activities from I Ur Och Skur schools.

Photo: Abigail Garbett September, 2019.

2.3 THE EXTINCTION OF EXPERIENCE: CAUSES AND CONSEQUENCES

The importance of HNC has been widely reported for a variety of reasons. From a sustainability perspective, exposure to nature in childhood has been linked with a persistent and deep-seated interest in the protection of natural environments (Miller, 2005). Robber Pyle explains this correlation by emphasising the importance of understanding the value of nature in a physical as well as emotional sense (2011).

According to several psychometric scales including 'The Nature Relatedness Scale', feelings of emotional affinity to nature such as empathy or sympathy are powerful predictors of sustainable behaviour (Kals et al., 1999; Nisbet et al., 2009; Soga & Gaston, 2016). A positive relation between emotional affinity towards, and the frequency of interactions with, natural environments has also been found (Nisbet et al., 2009). Such a correlation suggests that spending time outdoors reinforces our sense of connection to natural systems.

From the perspective of human health, exposure to natural environments is described by psychologists in medical terms as 'Vitamin G' (green) or 'N' (nature) due to its perceived positive influence on physical and mental wellbeing (Groenewegen et al., 2006). In terms of physical health, the decline in time spent outdoors is linked with a decrease in physical activity (Gray et al., 2015). While for mental wellbeing, comparative studies show spending time in nature can positively influence stress levels and is linked to feelings of vitality, life satisfaction and improved mental health (Soga & Gaston, 2016).

HNC also has the potential to have a positive ecological impact via improved biodiversity. The cultivation of allotment gardens, for example, can provide an important location for pollination, seed dispersal and the regulation of pests (Barthel et al., 2010). Activities that promote ecological regeneration and citizen engagement can be seen to have twofold benefits for humans and ecosystems. This is particularly significant in urban areas where levels of biodiversity and opportunities to interact with nature may otherwise be low.

The examples above suggest that interaction with natural environments can have mutually beneficial effects on human and ecosystem health. However, despite the perceived benefits, a recent study shows that in urban areas routine experience of nature has become the exception to the norm (Cox et al., 2017). The cycle of disaffection, termed by Robert Pyle as the 'extinction of experience', describes a phenomenon whereby the further removed an individual is from personal contact with nature, the less awareness and appreciation they have for it (Soga & Gaston, 2016) (figure 3).

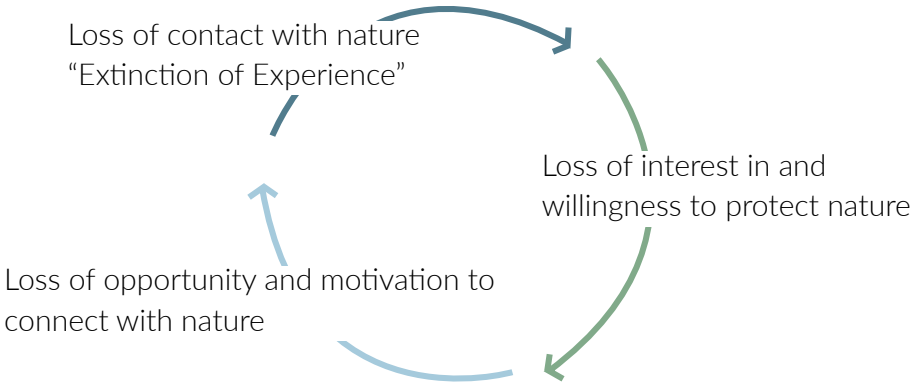

Fig. 3

Causes and consequences of loss of human-nature interactions.

(Direct citation from Soga and Gaston., 2016)

In the next section I will consider two interlinked causes of the extinction of experience for children; urbanisation and the increase of sedentary behaviour.

2.3.1 URBANISATION

> *'The future of the most of humanity now lies, for the first time in history, fundamentally in urbanising areas' (Harvey, 1996, p. 403).*

Urbanisation is a global phenomenon with over half the world's population currently living in urban areas (Capon, 2017). In Sweden, 86.11% of the population currently live in cities, a figure which is expected to increase to 90% by 2050 (United Nations et al., 2014). Globally, by 2030 urban land cover is predicted to increase by more than 1 million km2 compared to the amount in 2000 (Capon, 2017). Such a shift in land use threatens biodiversity via loss of habitat, biomass and carbon storage and significantly alters our relationship to natural environments. Having evolved with a direct dependence on the land as hunter-gatherer societies, today people face a mismatch between their evolutionary biology and built environment.

In the last century, city planners have prioritised motorized transportation and space efficiency at the expense of typical child-friendly values (Kyttä et al., 2018). Motorised transportation in particular, poses a threat to the safety of child free play in urban areas. As a result, spaces for children have become institutionalised and restricted to designated child-friendly areas such as playgrounds and school yards (Ibid). Simultaneously the number of public and private green space is in decline, particularly in less affluent neighbourhoods (Ibid). Thus, a reduction in access and opportunity to connect with nature on a daily basis is often the direct consequence of urbanisation (Shaw et al., 2013).

Poor access to greenspaces or recreational activities in dense urban areas have been associated with an increase in long distance travel for leisure purposes (Czepkiewicz et al., 2018). The emerging 'Compensation Hypothesis' proposes that one of the reasons people living in dense urban areas travel further or more frequently is 'to compensate for deficiencies in their living environment, such as access to green or open space' (Ibid, p.15). The hypothesis raises questions of environmental justice, since it suggests that only those who have the means and opportunity to travel

are able to compensate for environmental deficiencies within their urban living environment (in addition to the environmental impact of long-distance travel).

Within urban areas themselves, the inequity of access to greenspaces by urban populations has been widely documented. According to a recent study in the UK, 75% of the reported time spent in nature was experienced by just 32% of the population (Cox et al., 2017). Providing access to greenspace during school hours appears to be a positive method for addressing the inequity of opportunity to experience nature among children, provided pupils are from diverse economic and cultural backgrounds.

In recognition of the need to address biodiversity loss and the loss of nature experience at the urban scale, discourse around urban greening and ecosystem services have emerged. The term 'ecosystem services' is used to describe the benefits obtained from ecosystems, for example, food, water, hazed regulation, carbon sequestration, recreation and urban cooling (Kaczorowska, 2014). While urban greening refers to the intentional provision of resources for wildlife, including food, water, habitat and breeding areas within the urban context (Cox et al., 2017).

Urban nature has been promoted in various national and international agendas, including the UN 2030 Sustainable Development Goals (SGDS). SDG Goal 11, related to sustainable cities, calls for 'universal access to safe, inclusive and accessible, green and public spaces' while Goal 12, related to sustainable production and consumption, stresses the importance that 'people everywhere have awareness for lifestyles in harmony with nature' ("Sustainable Development Goals," 2015). The new UN Urban Agenda similarly aims to promote 'healthy lifestyles in harmony with nature' (United Nations, 2017) while on a local level, initiatives such as 'Green England' in the UK have stipulated that inhabitants should live within 300 metres of green space (Soga & Gaston, 2016). Such targets illustrate widespread acknowledgement of the importance of natural environments and our interaction with them.

2.3.2 'THE BACKSEAT GENERATION'

Alongside and linked to urbanisation, the extinction of nature experience in childhood has been attributed to the increase of sedentary pastimes and the micromanaging of children's lives (Soga & Gaston, 2016). According to Lia Karsten, children in the 21st century 'play outside less frequently and for less time, have a far more restricted home range and are subject to far more interference from their parents' (2005, p. 283). In contrast to the 1950s and 1960s when children's space-time behaviour could be characterised by just one type: 'outdoor children', today childhood can be categorised in three ways: 'outdoor children', 'indoor children' and 'backseat children' (Ibid.). The term 'backseat generation' refers to children whose space-time behaviour is centred around adult-organised programmes such as being escorted to music classes, sports lessons or other leisure activities. According to the study, the type of childhood is largely influenced by parental income and cultural heritage (Ibid.).

For children living in urban, economically developed nations, childhood has become increasingly home centred (Roberts & Foehr, 2008) and nature is frequently experienced indirectly, for example, through the car window or via documentaries. Studies also indicate that the increase in indirect experience of nature has led to a phenomenon whereby young children are aware of issues like climate change and the destruction of remote natural resources, but have little or no understanding of the plants that grow in their local area (Driessnack, 2009). This 'indoor-ification' of childhood in wealthy industrial and post-industrial cities appears to threaten children's embodied understanding of nature and their place within it.

2.4 THE DESIGN OF CHILD FRIENDLY LANDSCAPES

> *'A generation ago playing outdoors in nature was usually taken for granted, but times have changed. Now, nature must be deliberately designed back into children's lives' (Natural Learning Initiative, 2009).*

As previously established, designated 'child-friendly' areas such as parks and school yards, are many urban children's primary experience of the outdoors (Soulsbury & White, 2015). As a result, the quality and opportunities afforded by such spaces can have an important influence on children's development and wellbeing on a personal and environmental level (Brussoni et al., 2017; Stanley, 2010). Yet despite their critical role, such spaces have commonly been designed without consultation from children themselves, leading to play areas based on adult priorities of neatness and risk management (Samborski, 2019) and often at the expense of natural elements.

In this section I will discuss how the design of playgrounds and schoolyards in Europe and America has developed overtime as well as the benefits of natural play and learning environments.

2.4.1 PLAYGROUND DESIGN

Originating in the 1800s, western playground design was largely developed by two theoretical paths, the physical fitness movement and the experiential 'kindergarten' movement (Frost, 2006). The physical fitness movement began in Germany with the rise of fitness culture and involved taking gymnastic equipment traditionally designed for indoor use, outside (ibid). This theory was adopted by the American Playground Movement in the early 1900s, motivated by concerns over children playing in dangerous urban areas (Stanley, 2010). The influence of the physical fitness movement can be seen today in traditional playground design, which is characterised by large playing fields and fixed athletic equipment such as monkey bars, climbing apparatus, swings and slides (Susa & Benedict, 1994).

While traditional playground design affords multiple opportunities in terms of functional play, such as climbing, sliding and balancing, it has come under criticism for being overly homogenous, lacking in integration with natural elements and limited in terms of constructive and symbolic forms of play (Frost, 2006). Constructive forms of play include building dens or shelters and usually require the availability of loose parts while symbolic or make-believe play such as playing house, fairies or pirates often require concealed

or semi-concealed areas (Samborski, 2019).

In contrast to the rigid gymnastic equipment of the physical fitness movement, the Kindergarten movement inspired by the German pedagogue Friedrich Froebel, emphasised development and learning through free play (Frost, 2006). The name 'Kindergarten', which is a combination of the words 'kinder' meaning child and 'garten' meaning garden, reflects Froebel's pedagogical philosophy that children should be nurtured like plants in a garden (Muelle, 2005).

Playgrounds inspired by the Kindergarten movement, are characterised by natural and exploratory elements such as edible plants, sand, water, tools and loose parts (Frost, 2006). These areas are designed to encourage self-directed, make-believe and constructive play as well as care for plants and animals (Ibid). Today, the influence of the Kindergarten movement is mostly found in preschools (Stanley, 2010) and can also be seen as an influencing factor in 'contemporary playground design'. Contemporary playgrounds are characterised by connecting continuous structures with multiple levels and undefined enclosed play areas (Susa & Benedict, 1994).

In the mid-1900s, a third style of playground known as the 'adventure playground' emerged (Frost, 2006). The adventure playground was born out of recognition that children often preferred to play in 'left-over places' such as industrial sites or farmland which were quickly disappearing with the onset of urbanisation (Shier, 1984). In response, Danish landscape architect C. Th. Sorensen began to develop designated 'adventure playgrounds' which, inspired by the freedom afforded by these forgotten places, gave children the possibility to 'build and shape the environment according to their own creative vision' (Frost, 2006; Shier, 1984, p. 2).

Adventure playgrounds or 'junk' playgrounds are characterised by the presence of tools, scrap materials such as old tires and discarded lumber and trained play leaders who supervise activities (Shier, 1984). The adventure playground can be seen to be unique in putting the child at the centre of the design process, however due to adult perceptions of safety risks, a lack of funding and the junk-like appearance, adventure playgrounds remain a niche (Frost, 2006).

Despite early interest in the kindergarten and adventure playground movement, since the late 20th century the design of public playgrounds has been largely influenced by concerns over child-safety regulation and ease of manufacture (Frost, 2006). A consequence of the safety priority has been the reduction of natural elements within playgrounds which are frequently made-up of standardized plastic apparatus and furnished with asphalt as opposed to soil or sand in an attempt to mitigate risk and cushion potential falls. The on-going fixation with playground safety has also meant that for many children, playgrounds have become boring and unappealing for repeat visits (Natural Learning Initiative, 2009).

2.4.2 NATURAL PLAY ENVIRONMENTS

In response to concerns over children's wellbeing and lack of engagement with the outdoors, there has been increasing interest in the provision of natural play environments in urban areas (Natural Learning Initiative, 2009). The 'playground naturalisation' movement for example, advocates for creating and retrofitting existing playgrounds with natural elements such as trees, shrubbery and grass with the objective of enhancing children's interaction with nature and to encourage the use of outdoor play spaces (Natural Learning Initiative, 2009). This follows multiple studies that have shown natural environments afford more diverse possibilities for play and independent, child-driven experiences than playgrounds based solely on manufactured equipment (Azlina & S., 2012; Brussoni et al., 2017; Fjørtoft, 2001; Luchs & Fikus, 2013).

In terms of design, natural environments 'represent dynamic and rough playscapes' with diverse topography like slopes and rocks that challenge children in multiple ways (Fjørtoft, 2001, p. 111). Such environments are characterised by the availability of natural elements (Brussoni et al., 2017) and loose parts for example, plants, water, twigs and sand which form the centre of play situations (Luchs & Fikus, 2013). The term 'Loose Parts' as defined by Nicholson's Theory of Loose Parts, encompasses moveable components that offer many forms of use and open play possibilities (2009).

The presence of readily available natural loose parts combined with seasonal changeability can be seen to afford creativity and increase constructive forms of play (Luchs & Fikus, 2013). Trees and loose branches, for instance, afford multiple play possibilities including functional play such as climbing and balancing; constructive play such as building a tree-house; and symbolic play by providing a semi-concealed setting (i.e behind the tree trunk) for a make-believe game. Furthermore, forms of constructive play in natural settings, such as den building, have been linked to the development of communication and negotiation skills (ibid).

Comparative studies between biodiverse and conventional early childhood centres have shown that natural environments afford more opportunities of independent play, less competition over toys and longer and more complex play episodes (Brussoni et al., 2017). Similarly, a study of outdoor plays spaces for kindergarten children has shown a preference for using natural elements as opposed to traditional play equipment; 'they know that they could climb and slide on the playground but instead they preferred to challenge themselves using the log…hopping on and off'(Azlina & S., 2012, p. 282). This is supported by children's apparent preference for natural environments as indicated by studies of childhood memory which display a prevalence of natural settings among favourite places (Oloumi et al., 2012).

Despite the perceived dangers of nature-based play, natural play environments have been found to invite moderate play as opposed to manufactured equipment which linked to more 'vigorous activity' (Luchs & Fikus, 2013, p. 208). Similarly, according to the British 'Royal Society for the Prevention of Accidents', recorded accidents in adventure playgrounds is

lower than in other forms of playground, despite increased possibilities for risk (Frost, 2006).

In summary, natural play environments afford multiple play possibilities for children in comparison to fixed play equipment and traditional playground design. Furthermore, despite the increased possibility for risk, children's behaviour in natural environments is not considered to be more dangerous. Studies also indicate an important connection between the diversity of the landscape and the affordance of play and learning activities (Fjørtoft, 2001, p. 115). While, the amount of physical diversity (such as variations in topography) appears to increase learning and play possibilities (Ibid), the exact qualities of natural play and learning environments and practical design implications have yet to be fully explored in research (Ives et al., 2017).

3 THEORETICAL FRAMEWORK

3.1 THE THEORY OF AFFORDANCES

The theory of affordances provides a framework for understanding interactions between the physical properties of an environment and a human/animal subject (Gibson, 1979). In the thesis, this theory provides a basis for understanding human-nature connection and was used as a lense through which the case study was conducted.

Anthony Chemero (2003) describes affordances as the relation between the abilities of a person and the features of the environment. Affordances are seen to be the qualities of whole situations; thus, the 'affordance' of a situation belongs to both the human subject and the environment.

Chemero explains affordance through the relation of 'taller-than' (2003, p. 187). In this analogy, person A is taller than person B. 'Taller-than' is not seen to be an inherent quality of either person A or B but depends on them both in relation to one and another. Similarly, the ability to play in a natural setting is seen to be dependent on the individual and features of the environment. As a result, affordances are particular for each individual and/ or group of people (Kyttä et al., 2018).

3.1.1 AFFORDANCES IN CHILDREN'S OUTDOOR ENVIRONMENTS

The theory of affordance has been applied to children's outdoor environments in several studies (Giusti, 2019; Giusti et al., 2018; Heft, 1988; Kyttä, 2002; Kyttä et al., 2018; Svane, 2017). The approach allows environments to be analysed based on what potential affordances exist for children and how they are 'perceived, utilised and shaped' (Kyttä, 2002, p. 109).

Affordances have a developmental quality, given that situations within a particular environment are dependent on an individual's particular physical and cognitive abilities (Heft, 1988). As a result, affordances are seen to be particularly dynamic for children, who are growing and developing. For example, an eight-year-old child may perceive a lake as 'swimmable' because the combination of environmental qualities and the (perceived) abilities of the child affords the act of swimming. In contrast, a four-year-old child may not be able to perceive the lake as 'swimmable' because she may lack the physical ability to swim. The example demonstrates that what an environment affords is likely to change over time as children develop new cognitive and physical abilities.

Abilities to engage with an environment are also likely to deepen as affordances are repeatedly actualised through frequent interaction (Giusti et al., 2018). Using the example above, the more often a child is able to swim in a lake, the more likely it is that they will become confident in swimming there. Repeated engagement with the lake allows for potential new layers of

interaction between the environment and the child to develop.

In addition to physical and cognitive abilities, affordances are shaped by the social or cultural context of a situation (Giusti, 2019). This is particularly true for children, since their free and spontaneous actions are frequently mediated by the supervision of an adult (Kyttä, 2002). In the swimming example, though the child may perceive the potential affordance of swimming, whether the affordance is actualised may be dependent on whether a supervising adult offers caution or encouragement. Thus, a child who is never given permission to swim is unlikely to develop the same connection to the lake as a child who frequently swims there. The influence of perceived restrictions or permissions plays a pivotal role in how children relate to and interact with outdoor environments (Ibid).

3.1.2 AN EMBODIED ECOSYSTEM APPROACH

The embodied ecosystem approach utilises affordance theory to explain how ecosystems are coproduced by humans and nature. The approach challenges the ontological separation of the mind and body and thus a 'disembodied' approach to human-nature connection (Raymond et al. 2018). This approach recognises that embodied ecosystems and the value they provide is dependent on perception-action processes (Ibid). In other words, how the affordances of an environment are actualised is dependent on the relations between the mind, body, environment and the culturally specific meanings present within a specific location (Ibid) (See figure 4). This means that by acting in an environment, individuals influence the type of affordances that can be perceived, used and shaped there.

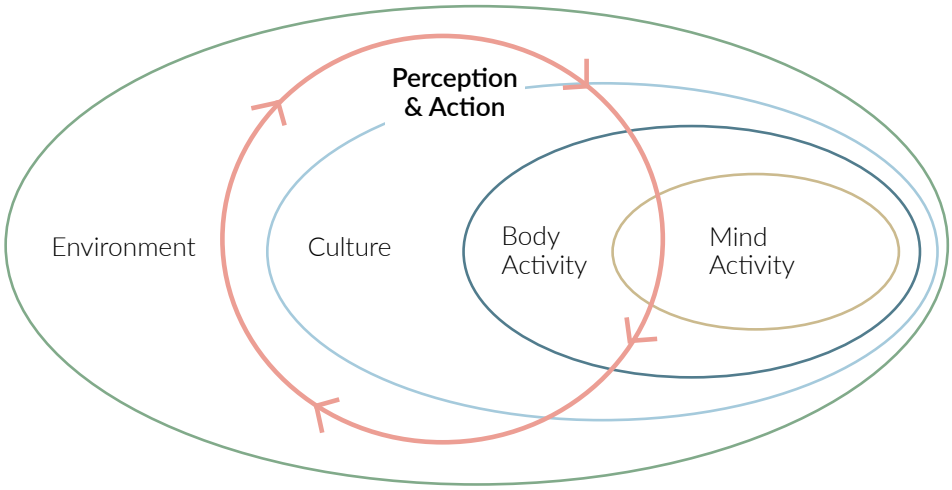

Fig. 4
Embodied Model of Cognition including cultural processes, adapted from Hinton (2014)
(direct citation from Raymond et al. , 2018)

As a result of constant negotiation between actualised and non-actualised affordances, the value an ecosystem provides is dynamic and subject to change. For example, to a child with the physical and cognitive ability to be curious about nature, walking in a forest environment may afford a restorative and thought-provoking situation. However, if the same forest is visited by a child without such abilities, the situation may be exhausting or even frightening. How the interaction is perceived can lead to collapsing relations, i.e. the child does not want to visit the forest again or emergent relations, i.e. the child discovers new ways to interact with the environment and new affordances are created (Raymond et al., 2018).

In this thesis, the embodied ecosystem approach provides a theoretical lense for observing the interaction between children and the environmental features of the places they visit. It also provides a structure for considering how to design opportunities for human-nature connection based on new or emergent relations within the observed settings (Ibid).

3.2 THE ACHUNAS FRAMEWORK – WHERE AND HOW CHILDREN CONNECT TO NATURE

'The Assessment Framework for Children's Human Nature Situations', known as ACHUNAS (Giusti et al., 2018), provides a practical criterion for users to assess the child-nature connecting qualities of particular environments.

According to the framework, a child's connection to nature is characterized by the types of ability they display. Children's HNC is composed of 10 abilities which are made up of cognitive, affective and behavioural aspects and can be clustered into three progressive groups; 1. Being in Nature (for example, being curious about nature), 2. Being with Nature (for example, reading nature spaces and knowing about nature) and 3. Being For Nature (for example, caring about nature) (See Table 1 for details). To understand how the abilities of HNC develop, the framework also outlines 16 qualities of significant nature situations (SNS) which have the potential to promote children's HNC (see table 2). Rather than describing specific nature activities, the list acts as a guide for observing qualities that occur in different scenarios. As a result, a significant nature situation may be categorized by one or more of these qualities. The qualities are clustered into six sub-groups; entertaining, environmental epiphanies, restorative experiences, nature free play, nature school and animal engaging (See table 3 for details).

In this thesis, the framework was applied directly as a practical and theoretical guide to understanding what kind of significant nature situations occur within pedagogical greenspace during the case study and analysis phase of research.

Table 1. List of abilities of human-nature connection with associated brief descriptions. The table can be read as, "a child connected to nature is capable of (abilities of HNC)" (*Direct citation from Giusti et al., 2018, p. 9)*

Abilities of HNC	Brief Description
(Being IN nature)	
Feeling comfortable in natural spaces	The child demonstrates ease in natural spaces and feels comfortable with natural elements in the outdoors (e.g., dirt, mud, rain, or the sun).
Being curious about nature	The child shows interest and motivation in exploring nature.
(Being FOR nature)	
Reading natural spaces	The child is able to see the possibilities for action in natural spaces that are not purposefully designed by man.
Acting in natural spaces	The child is able to perform activities in nature, for example, nature playing, camping, or outdoor sports in nature.
Feeling attached to natural spaces	The child shows a sense of belonging to specific natural spaces, to which they feel part of.
Knowing about nature	The child demonstrates knowledge of animals, plants, and ecological dynamics.
Recalling memories with nature	The child is able to recall past nature experiences and tell stories of lived experiences with nature.
(Being WITH nature)	
Taking care of nature	The child is able to be responsible for nature and feels empowered to act for the wellbeing of nature.
Caring about nature	The child is able to feel care, concern, sensitivity, empathy, and respect for nature.
Being one with nature	The child is able to identify with nature and has a sense of profound personal attachment to nature that can be described as spiritual. Love for nature, humbleness in relation to nature, and assuming to be a small part of the immensity of nature are manifestations of this ability.

Table 2. List of qualities of significant nature situations with associated brief descriptions. The table can be read as "A significant nature situation is characterized by (quality of SNS)" ***(Direct citation from Giusti et al., 2018, p. 7)***

Qualites of SNS	Brief Description
Entertainment	Nature situations that are fun, joyful, amusing, or enjoyable.
Thought-provocation	Nature situations that create new ways of conceiving human-nature interaction.
Intimacy	Nature situations that are private or intimate and allow a personal experience with nature.
Awe	Nature situations that are amazing, of overwhelming attraction, or mesmerizing, that create a "wow effect."
Mindfulness	Nature situations that grasp children's focus and alertness, that make children "be in the flow."
Surprise	Nature situations that are unpredictable or unexpected. In these nature situations children's line of thought is interrupted, and nature draws their attention.
Creative expression	Nature situations that involve arts, myths, stories, music, or role-play.
Physical activity	Nature situations that require body movement or any form of physical activity.
Engagement of senses	Nature situations that activate children's senses (smell, touch, hearing, etc.)
Involvement of mentors	Nature situations that involve persons, such as teachers, experts or relatives, who are capable of inspiring, encouraging, or leading the nature experience for the child.
Involvement of animals	Nature situations that involve interaction with animals.
Social/cultural endorsement	Nature situations that involve positive peer pressure, support from significant others, social acceptance, or cultural reinforcement.
Structure/instructions	Nature situations characterized by a set of rules that define the frame within which the child can act.
Child-driven	Nature situations that are chosen by the child, child-initiated (children autonomously decide when to begin the nature activity), and open-ended (children autonomously decide when to conclude the nature activity).
Challenge	Nature situations in which children overcome psychologically or physically adverse conditions, such as fear or cold.
Self-restoration	Nature situations of psychological, physical, or social relief. For example, relief from stress, fatigue, or gender stereotypes.

Table 3. SNS Qualities clustered in to six macro categories (Giusti et al., 2018)

ENTERTAINING	ENVIRONMENTAL EPIPHANIES	RESTORATIVE EXPERIENCES	NATURE FREE PLAY	NATURE SCHOOL	ANIMAL ENGAGING
Entertainment	Thought-provocation	Intimacy	Creative Expression	Involvement of mentors	Involvement of Animals
	Awe	Mindfulness	Physical Activity	Structure/ Instructions	
	Surprise	Self-restoration	Challenge	Social/ Cultural Endorsement	
			Engagement of Senses	Thought-provocation	
			Child driven		

4 METHODOLOGY

4.1 CASE STUDY: I UR OCH SKUR

I Ur och Skur (approximately translated as 'In rain and shine'), is a full-time, experience-based outdoor pedagogy utilised by schools and preschools (Webpage: Friluftsfrämjandet).

The pedagogy was first developed in Stockholm in the 1980s, in collaboration with Friluftsfrämjandet, the largest outdoor association in Sweden. Today there are over 200 I Ur och Skur (IUS) preschools and 8 primary schools located across Sweden and in several locations abroad (Webpage: Friluftsfrämjandet).

4.1.1 PEDAGOGICAL APPROACH

The overarching purpose of the IUS pedagogy is to inspire a deep-rooted connection to the natural world (Änggård, 2010). The pedagogy is characterised by experiential learning and activities such as arts and crafts, drama, storytelling, music and physical movement which are mediated by the seasons and the availability of natural materials with the purpose of linking learning to the environmental context (Svane, 2017).

> **In addition to the goals outlined by the Swedish national curriculum, IUS schools aim that every child:**
>
> **Develops an interest in, knowledge about and a 'feeling' for nature (Swe. 'Naturkänlsa').**
>
> **Develops knowledge about sustainable lifestyles.**
>
> **Develops knowledge about and acts in accordance with the Right of Public Access[1] (Swe. Allemansrätten).**
>
> **Receives support and stimulation throughout their development by being in nature.**
>
> **Is provided with enjoyable opportunities for movement and community in nature.**
>
> **Develops the basis for a lifelong interest in outdoor life (Swe. 'Friluftsliv'). (Webpage: Friluftsfrämjandet, English translation by the author)**

The core goals of the IUS pedagogy is illustrated in the method circle (see figure 5). The student is put in the centre of the circle to demonstrate the importance of child-led learning and play. Surrounding this are eight sub-categories, these include: play and adventure, outdoor pedagogy, parental interaction, different forms of expression, theme/project, conscious leadership, nature and environmental knowledge and Friluftsfrämjandet activities.

[1] The Swedish Right of Public Access, known as 'Allemansrätten', allows people to roam freely in the countryside on the condition that consideration is shown to the local wildlife and the people who live and work in the area (Sverige & Naturvårdsverket, 2011).

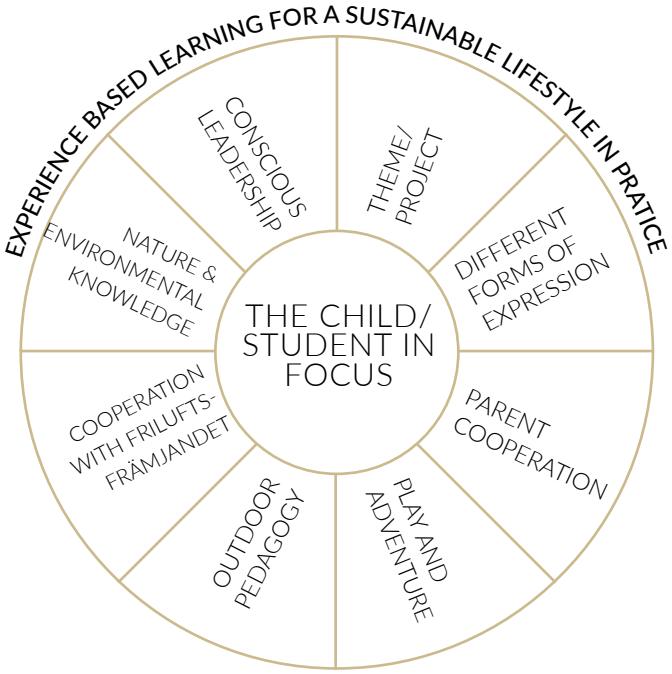

Fig. 5
IUS Method Circle
(Translated from Swedish by the author)
(Webpage: Friluftsfrämjandet)

Friluftsfrämjandet activities and teaching materials are integrated into the IUS pedagogy in various ways. For example, IUS schools use a set of make-believe forest characters developed by Friluftsfrämjandet to encourage children to use their imagination while learning about subjects such as environmental protection, local ecology and bush craft (Webpage: Friluftsfrämjandet).

4.1.2 CASES

Three IUS schools/preschools were selected for the study based on the criteria that they 1) follow the IUS pedagogy and 2) are based in the Stockholm region. The schools/preschools visited used diverse greenspaces, ranging from traditional playgrounds to nature reserves. These landscapes were made up of various organic and artificial elements, fixed and loose parts and differed in size. In some cases, the human influence was visible in a footpath or ring of logs within a nature reserve, in others it took the form of a fully planned and designed school yard.

I will now present a brief description of the physical qualities of each school. For clarity, I will refer to the schools/preschools as schools 1-3.

SCHOOL 1 was a combined school and preschool situated on a quiet residential street. This was the largest school I visited with approximately 100 children between the ages of four and eleven. The building and school yard were originally designed as a traditional preschool and was later adapted for IUS school purposes. The outdoor space was approximately 6,000-5,000 square meters and was divided into three key areas.

There was one large main play area at the back of school which included a sandpit, swings, a slide, fruit trees, vegetable boxes and four picnic tables close to the school building as well as a more densely forested area at the top of a small slope which included several large wooden play structures, three rings of logs (for children to sit around), a large tipi and a sail tied between trees to create shade. The second medium sized area to the left of the school included more picnic benches (for use at lunch time), a small

shed, a few trees and steep rocky slope. The third area situated at front of the school was not observed as it was used by children under the age of 3.

At the back of school 1, there was a public forest which was accessible from the school yard via a stile. The forest was utilised by each class at least one day per week. Each age group had their own special area in the forest which they frequently visited.

During my observations I went with the 4-5 years old children to 'Mulleplats'. The children walked in the forest for approximately 30 minutes to reach the area. At Mulleplats there is a large flat rock with a ring of benches and a fire pit. Surrounding this was a variety of trees, blueberry and lingonberry bushes which the children enjoyed picking, fallen trees which the children practiced balancing on and a couple of shelters made from sticks propped against a central tree. There were also a few signs with pictures of local animals tied to the trees.

SCHOOL 2 was also a combined school and preschool situated within an apartment block in a fairly densely built residential area. There I observed approximately 45 children between the ages of four and nine. Unlike school 1 and 3, school 2 did not have an official school yard. Instead, the school utilised a public park five minutes' walk from the school building on a daily basis. The area of the public park used by the school was approximately 4,000 square meters. This was a forested area with gentle slopes, clearings and footpaths going through.

Different groups used different parts of the park. The youngest children were based at the edge of the tree line, while the older children used parts slightly further inside. The schools did not have any permanent infrastructure in the park but they made use of three rings of logs for sitting on and holding class. All other materials were brought to the area every morning by the teachers and returned to the main building at the end of the day.

Once per week the children visited a different nature area. On one occasion this was a nature reserve situated within the public park. This was about 30 minutes' walk from their usual meeting place and was much richer in biodiversity. For instance, there was more moss and lichen on the ground, lingonberry bushes and edible roots. On another occasion they took a short bus ride (approx. 15 minutes) to a nearby national park with a large lake.

School 2 also utilised a small traditional public playground and grass lawn directly in front of the school building during certain lessons and playtimes. This area had a small climbing frame, swings, a sandpit and shed which had more traditional outdoor play/sports equipment such as balls, buckets and spades inside. In front of the school building itself was approximately five picnic benches and two vegetable boxes. For physical education lessons they also utilised a local sports field which was made of artificial turf.

SCHOOL 3 was a newly built preschool located in a residential area in a developing part of Stockholm. There I observed approximately 70 children between the ages of three and five. This was the only school that was specifically designed and built for IUS purposes. In total the outdoor area was approximately 5,000 square meters and was divided into the three key areas.

The school building formed a U shape around a central yard which included a sandpit, wooden play structures, small willow trees shaped into shelters, vegetable boxes and a couple of sheds. The roof of the building was extended to create a semi sheltered area facing the central yard. This area had tables, benches and logs for sitting on and was used for arts and crafts activities, story time and playing with puzzles etc. On one side the shelter was extended to make room for more tables which were used during lunch times and theatre sessions put on by the teachers/carers.

In front of the school yard was a small nature area with trees, rocks, tree stumps and a ring of logs surrounded by circle of bushes. Behind the school was a second play area which backed on to nature reserve accessible via gate. In the second play area there was another sandpit, more wooden play structures, three picnic tables and vegetable boxes.

In the nature reserve behind the school there was two tipis, an area with decking and grill, trees and rocks. During certain playtimes children were allowed to play in a part of the nature reserve closest to the school. During certain lessons/play sessions they also walked further into the reserve. On one occasion, I accompanied a class to a different nature area which was approximately 30 minutes' walk from the school.

The area around the school was under extensive construction work and a teacher noted that in the four years since the school opened, the available nature areas around the school had decreased significantly. She also noted that it was fortunate that the area behind the school had been classified as a nature reserve as this meant it was protected from further development.

Overall, school 2 was the most distinctive since it did not have a school yard or permanent outdoor space. It relied the least on infrastructure and artificial play props since these could not be carried to the public park every day. However, there were some basic similarities between the three schools. For instance, all had daily access to some kind of forest area (including trees, variations in topography and exposed soil), open space and loose parts (such as bricks, sticks or wooden planks). They were also all situated within 200 metres of public nature areas and at least one day per week was spent there or visiting a local nature area further away from the school. According to one of the teachers, visiting different areas is an important part of the IUS curriculum which encourages children to learn more about their local area and to experience diverse nature situations.

4.2 METHODS

The primary method used was participatory observation of naturally occurring events within an outdoor school setting. By engaging in participatory observation, the researcher's role in the research situation is typically more overt and may involve direct interaction with the research participants (Palmer, 2001). This was deemed a useful observation method as it created a less formal atmosphere which helped put the child participants at ease. This method was complimented by informal discussions with school staff members and child participants and visual documentation.

4.3 PROCEDURE

Between September and October 2019, I spent five to six days at each school for approximately seven hours per day. On a typical day I would arrive at eight or nine in the morning (when the school day began) and would follow a class through their daily activities, including lessons, lunch, playtime and occasionally during after school activities (Swe: fritidsklubbar). The study was organised so that I would observe outdoor classes. This meant the group of children I observed differed depending on their indoor/outdoor schedule.

I was able to engage in informal dialogue with both the children and teaching staff and to participate in certain group activities such as 'story time' and circle discussions and occasionally I helped the children with small tasks. The level of participation at each school differed depending on the teaching style and the interest of the children. Such interactions contributed to my understanding of each learning environment and helped me to make sense of the reasons why areas were selected for certain activities but not others.

In each school, the observations focused on identifying the physical attributes of nature situations that I deemed to be significant for the children involved. For each significant nature situation (SNS) observed, a title, description of the situation and related qualities were recorded alongside notes on the physical attributes of the spaces and materials used (see figure 6). Each quality was documented only once per activity. Data was collected via written notes, recorded using an observation guide (Appendix 1) and photographs of the spaces used.

TITLE Den Making
DESCRIPTION Make believe den making, hiding and quiet play.
QUALITIES Intimacy, Mindfulness, Challenge. Creative Expression and Child-driven.
PHYSICAL PROPERTIES Trees, loose pieces of wood, secluded space and forest floor.

Fig. 6
Example of a recorded SNS.

4.4 ETHICAL CONSIDERATIONS

As the study involved a vulnerable population, there were serious ethical factors to account for. To ensure anonymity of participants, the names of the schools, staff and students were not recorded and no identifiable photographs were taken of the research participants. In response to child protection concerns, I obtained official government clearance to work with minors (utdrag från belastningsregistret) and only conducted observations in the presence of a teacher or caregiver.

To obtain informed consent various steps were taken. First, before commencing the study, written permission from the principals of each of the selected schools was confirmed (see appendix 3). Second, the parents / caretakers of the participants were provided with an information sheet stating the aims and methods of the study and were given the opportunity to deny their child's participation (see appendix 4). Third, once at the school, a verbal briefing and written information sheet was provided to the involved staff, stating the situation and aim of the study and allowing time for questions or comments.

A final measure was to seek the informed assent of the child participants based on information appropriate to the child's level of cognitive and emotional development (Felzmann, 2009, p. 104). This was obtained by the teacher in charge via an informal group discussion about the research aims and methods and the duration of the study. A short, written summary was prepared in Swedish which was provided to aid the teacher's explanation. Additionally, the child's assent was viewed as an ongoing process which could be renegotiated at each stage of research. Non-verbal signs and cues from the participants which might indicate their enthusiasm or reluctance to be observed were respected.

The ethical procedure was reviewed and approved by Aalto University's ethics committee (see appendix 5).

4.5 DATA ANALYSIS

The observational data was digitally recorded and then analysed qualitatively using the data analysis program Atlas.ti. Analysis of the data took place through four key stages. First, the recorded qualities and physical properties of each SNS were coded. Second, the qualities were clustered into five macro categories based on their co-occurrence in the coding. Third, each SNS was subsequently assigned and coded with a macro category based on the qualities attached to it (further explanation in 5.1.1). Finally, the physical properties of each SNS were clustered into three macro categories based on their similarity and prevalence (further explanation 5.2).

5 RESULTS

Fig. 7
'Snail home'.
Photo: Abigail Garbett
October, 2019.

The results of the case study will be explained through four key stages. First, observations regarding the number, type and categorization of significant nature situations will be explained and discussed. Second, the recorded physical properties of the observed spaces will be explored with key insights into the number and importance of different physical properties. Third, I will examine the physical properties recorded in relation to each of the five SNS categories. Finally, I will consider synergies and trade-offs between the different SNS categories with insights into the ways the design of pedagogical greenspaces could be enhanced.

5.1 SIGNIFICANT NATURE SITUATIONS

During 17 days of observation, I recorded 945 significant nature situations. There was no significant difference in the number of SNS observed in each school with the total number of recordings for each school being 260, 343 and 342. One possible reason for the first school having fewer recordings is that during my visit, their weekly trip to a nature area outside the school premise was replaced with a running exercise (swe: skoljoggen) where less SNS were recorded than during the other nature area trips I observed.

Overall the children displayed multiple HNC abilities, including being comfortable in outdoor spaces, reading and acting in natural spaces, being curious about nature and in some instances, taking care of nature. However, one teacher noted that when children who have not experienced outdoor education before join the school, they often have difficulty understanding how to interact with the natural environment and take time to adjust. For example, they show signs of boredom and spend time patrolling the boundary of the nature area being unable to see the play and learning possibilities within it. This points to the importance of repeated nature experiences for enabling the development of HNC and the role of a mentor in creating a safe space during the development of these initial abilities.

Of the significant nature situations observed, a total of 4069 SNS qualities were recorded. These qualities include entertainment, thought-provocation, awe, surprise, intimacy, mindfulness, self-restoration, creative expression, physical activity, challenge, engagement of senses, children-driven, involvement of mentors[2], structure/instructions, social/cultural endorsement and involvement of animals. The occurrence of qualities shows that there is a large range in the number of times qualities were observed and that certain qualities tend to co-occur (See table 4).

[2] It is important to note that while mentors/teachers were present for all the recorded SNS, 'involvement of mentors' was only recorded when mentors played an active role in creating the SNS. For instance, by showing a child a specific phenomenon or instructing/guiding them in particular activity.

Table 4. The co-occurrence of SNS Qualities & total number each quality was observed.

	Entertainment	Thought-provocation	Awe	Surprise	Intimacy	Mindfulness	Self-Restoration	Creative Expression	Physical Activity	Challenge	Engagement of Senses	Child-driven	Involvement of mentors	Structure/Instructions	Social/Cultural Endorsement	Involvement of Animals
Thought-provocation	28															
Awe	9	35														
Surprise	5	7	8													
Intimacy	19	21	13	3												
Mindfulness	30	11	5	1	28											
Self-Restoration	16	15	3	0	32	41										
Creative Expression	159	22	5	2	39	86	33									
Physical Activity	201	14	1	1	23	2	0	29								
Challenge	100	12	2	0	17	8	3	22	118							
Engagement of Senses	87	58	39	14	73	59	32	61	17	19						
Child-driven	354	56	32	8	132	134	80	265	207	121	215					
Involvement of mentors	77	126	42	11	25	30	48	57	49	31	67	55				
Structure/Instructions	51	99	29	8	17	23	37	38	37	24	41	11	184			
Social/Cultural Endorsement	6	56	24	6	13	8	4	9	3	1	23	25	68	40		
Involvement of Animals	2	28	32	3	15	9	0	5	0	0	28	23	31	19	20	
Total no. of recordings	436	182	72	21	170	177	144	336	265	164	292	714	290	207	83	54

In the ACHUNAS framework, SNS are clustered into six categories: 'Entertaining', 'Environmental Epiphanies', 'Restorative Experiences', 'Nature Free Play', 'Nature School' and 'Animal Engaging' (Giusti et al., 2018, p. 9). However, it appeared that while the SNS qualities worked well for describing the types of nature situations observed, the categories outlined did not always fit the co-occurrence of the qualities in this data. As a result, three of the original categories were removed: 'Entertaining', 'Environmental epiphanies' and 'Animal Engaging', and 'Nature Free Play' was subdivided into 'Creative Experiences', 'Physical Free Play' and 'Sensory Experiences' (See figure 8). First, I will explain my motivation for removing/dividing the original categories and in the following section I will explain the new categorisation.

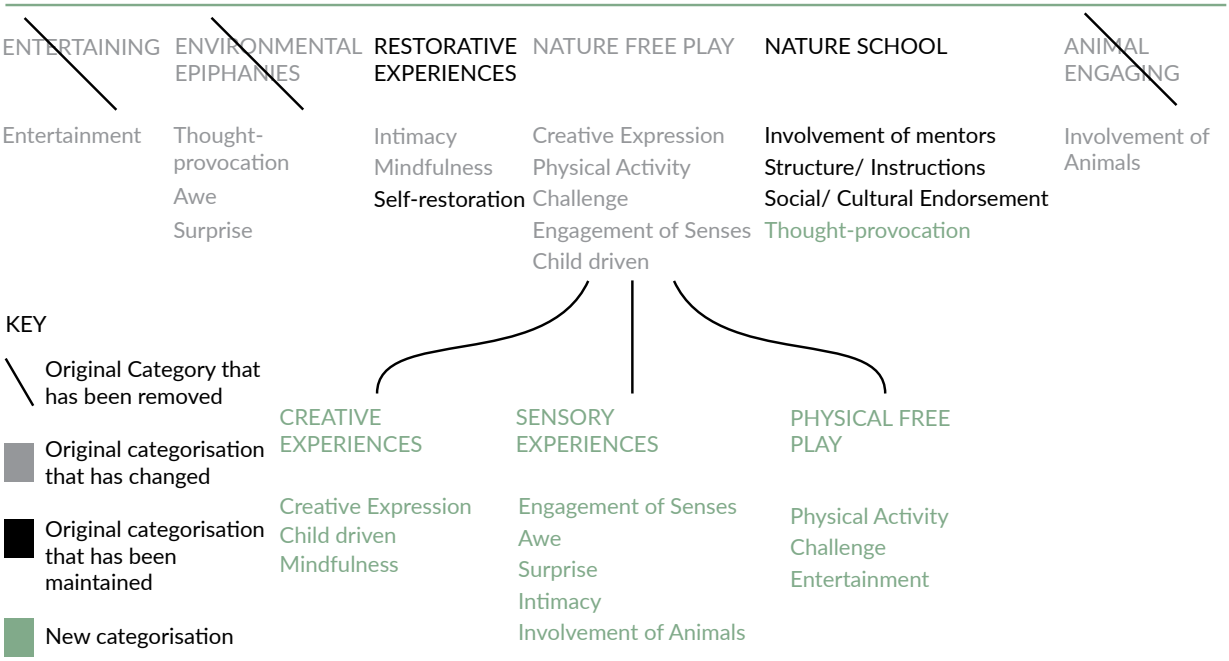

Fig. 8
Illustration of the recategorization of SNS qualities.
Original Categorization by Giusti et al., 2018, p. 9

First, the decision to remove the category 'Entertainment' was based on the finding that while the quality 'entertainment' was the second most recorded quality (436 recordings), it did not appear to be particularly distinctive. For instance, I observed that situations that were considered entertaining were difficult to define because they occurred in many different locations and for various reasons. However, they were frequently experienced in relation to free play activities. This is evident in the results which show that Entertainment' cooccurred 354 times with 'Child-driven', 201 times with 'Physical Activity', 159 times with 'Creative Experiences' and 100 times with 'Challenge'. As a result, I decided to include 'Entertainment' within 'Physical Free Play'.

Second, I decided to remove the macro category 'Environmental Epiphanies' because the qualities within this category did not occur together very frequently. For instance, 'thought-provocation' only co-occurred 35 times with 'Awe' and 7 times 'Surprise' but co-occurred 126 times with 'involvement of mentors' and 99 times with 'Structure / Instructions'. 'Awe' and 'Surprise' were also more frequently linked to 'Engagement of Senses' (39 and 14 times respectively). While the decision to remove this category

appears to fit the data gathered in this study, it is perhaps limited by the fact 'Awe' and 'Surprise' were comparatively seldom recorded. In a longer study, it is possible that a stronger connection between these qualities could be found that would justify keeping the 'Environmental Epiphanies' category.

Third, I decided to remove the macro category 'Involvement of Animals'. While involvement of animals appeared to be appreciated by the children and important for the development of SNS, they were the second least recorded quality with only 54 observations in this study. The low number suggests that 'Involvement of Animals' may be better suited to being part of larger group than a distinct category. This is supported by the data that shows 'Involvement of Animals' frequently co-occurred with qualities within the 'Sensory Experiences' category ('Awe', 32 times and 'Engagement of senses', 28 times,). As result, it was decided to include 'Involvement of Animals' within the 'Sensory Experiences' category, although it is also closely linked with qualities coded as 'Nature School' ('Involvement of mentors', 31 times and 'Thought provocation', 28 times).

The low number of recordings for 'Involvement of Animals' may be due to the fact that animals and insects, etc., were not a permanent part of any of the schools' daily activities but rather appeared spontaneously. For instance, when the children found many snails on a rainy day. If engagement with animals was a larger part of the school's curriculum, it may be justified to continue using this original categorisation.

Finally, as the observed schools regularly utilise a child-driven pedagogy, it was deemed disadvantageous to use the macro category 'Nature Free Play'. This is evident in the observational data which show that 'child-driven' is the most commonly recorded quality with 714 observations. Consequently, this category was sub-divided into three distinct groups: 'Creative Experiences', 'Physical Free Play' and 'Sensory Experiences'. This allowed for more precision when describing the type of free play in question. With the exception of child-driven, the division of this group was determined by the number of times each quality was recorded.

5.1.1 NEW CATEGORISATION OF SNS

The new categorisation aims to group qualities based on several factors, including co-occurrence, number of observations and the perceived distinctiveness of each quality. The five new categories are: 'Restorative Experiences' (including self-restoration), 'Creative Experiences' (including creative expression, mindfulness and child-driven), 'Sensory Experiences' (including awe, surprise, intimacy, engagement of senses and engagement of animals), 'Physical Free Play' (including physical activity, entertainment and challenge), and 'Nature School' (including thought provocation, involvement of mentors, structure/instructions and social/cultural endorsement) (see figure 8).

All SNS previously observed were then re-coded using the new categorisation. This re-coding was based on the highest combination of qualities recorded. For example, the significant nature situation, 'making a den' was categorised as a 'Creative Experience' because three out of the recorded five qualities

(i.e. “Creative expression”, “Mindfulness”, and “Child-driven”) are part of the ‘Creative Experiences’ category (figure 9)[3].

TITLE Den Making
DESCRIPTION Make believe den making, hiding and quiet play.
QUALITIES Intimacy, Mindfulness, Challenge. Creative Expression and Child-driven.
PHYSICAL PROPERTIES Trees, loose pieces of wood, secluded space and forest floor.

Fig. 9
Example of a recorded SNS.

The new categorisation does not eliminate overlap between the categories, (this would be perhaps impossible since every nature situation is unique and made up of various qualities) however, it reduces such overlaps and create a more meaningful distinctions between categories for the case studies taken into consideration here.

In the following paragraphs I will describe the qualities of each of SNS category in detail.

SELF-RESTORATION

Building on Giusti et al.’s definition of the quality ‘Self-Restoration’, ‘Restorative Experiences’ are understood as nature situations that promote psychological, physical or social restoration, for example, ‘relief from stress, fatigue or gender stereotypes’ (2018, p. 7). ‘Restorative Experiences’ were recorded 113 times and include the quality ‘Self-Restoration’. It was decided to remove ‘Mindfulness’ and ‘Intimacy’ from the original version of this group as ‘Mindfulness’ was observed more frequently in relation to ‘Creative Experiences’ (86 recordings) and ‘Intimacy’ was observed more frequently in ‘Engagement of Senses’ (73 recordings) than ‘Sensory Experiences’ (41, and 32 recordings respectively).

Observed nature situations that were considered restorative include: listening to a story read by a teacher or peer, stopping for lunch or a snack outside, playing quietly alone or in small groups with bricks or other small play props, engaging in make believe play that involved reversed gender norms and resting in nature. Perhaps due to its rather specific quality, i.e. promoting restoration, ‘Restorative Experiences’ was the smallest recorded category.

CREATIVE EXPERIENCES

‘Creative Experiences’ are defined as nature situations that grasp children’s focus through forms of open-ended creative expression and imaginative play. ‘Creative Experiences’ were recorded 248 times making it the most frequently recorded category. Qualities included are ‘creative expression’ (248 recordings), ‘mindfulness’ (74 recordings) and ‘child-driven’ (228 recordings). This category is also strongly associated with ‘Entertainment’ (138 recordings) and ‘Intimacy’ (33 recordings).

The types of nature situations that were coded as ‘Creative Free Experiences’ include: painting, drawing, dancing, singing, playing make believe games, building dens, whittling and sewing. ‘Make believe play’ is understood as a loosely structured form of play that generally includes role-play, object substitution and nonliteral behaviour (Singer et al., 2010,

[3] When a nature situation was ambiguous, i.e. when there was an equal number of qualities from two different categories, the presence of the most recorded quality from each category was used as signifier as to which category it belonged to.

p. 79). Examples of observed make believe play include playing as families or animals, playing shop, cooking, sword fighting and hunting.

SENSORY EXPERIENCES

'Sensory Experiences' are defined as nature situations that activate children's senses with the potential to promote unexpected, personal or mesmerising outcomes. 'Sensory Experiences' were recorded 215 times and included the qualities: 'Intimacy' (63 recordings), 'Awe' (39 recordings), 'Surprise' (13 recordings), 'Engagement of Senses' (215 recordings) and 'Involvement of Animals' (28 recordings).

Examples of observed 'Sensory Experiences' include: playing with natural elements such as sand, water or mud, tasting edible plants and berries, and engaging with animals and insects via sight, touch or sound. Sensory experiences were observed fairly often, and is the second largest recorded category. This is partly due to the large amount of time the children spent playing with sand during free-play sessions. Rainwater was also frequently used in sensory play and was present on almost half of the days I conducted observations. In dryer weather it is possible that the number of sensory experiences recorded would be reduced. Similarly, taste experiences such as foraging and eating blueberries are seasonally dependant and are likely to vary throughout the year.

PHYSICAL FREE PLAY

'Physical Free Play' situations are defined as enjoyable or amusing nature situations that involve different forms of body movement and physical or psychological challenge. 'Physical Free Play' situations were observed 227 times. Included in the category are the qualities: 'Physical Activity' (227 recordings), 'Challenge' (117 recordings) and 'Entertainment' (117 recordings). The quality 'Child-driven' is also strongly linked to 'Physical Free Play'(199 recordings). Types of observed physical free play include: running, chasing and catching each other, playing with a ball, walking, climbing and balancing.

NATURE SCHOOL

'Nature school' activities are defined as nature situations that are initiated by adult leaders and defined by a set of rules that frame the ways in which the child can act. They often involve social acceptance, cultural reinforcement or thought-provoking elements. 'Nature school' activities were recorded 142 times. Included in the category are the qualities: 'Thought-provocation' (106 recordings), 'Involvement of Mentors' (142 recordings), 'Structure/Instructions' (111 recordings) and 'Social/ Cultural Endorsement' (55 recordings) . 'Involvement of animals' is also frequently associated with 'Nature School' (23 recordings).

Examples of observed 'Nature School' activities include a variety of outdoor lessons (such as woodwork, sports, maths, Swedish, English and art), mentor led walks in the forest and supervised interactions with local wildlife.

From table 5, the distinction between certain qualities is clear, for instance

the qualities: 'Thought Provocation', 'Involvement of Mentors' and 'Social/ Cultural Endorsement', are recorded significantly more in relation to 'Nature School' than any other category. Similarly, it is possible to see that 'Physical Free Play' rarely involved 'Awe' or 'Mindfulness'. Whereas 'Restorative Experiences' rarely involved 'Physical Activity', 'Challenge' or 'Surprise'. However, other qualities such as 'Child-driven' and 'Involvement of Animals' are less distinctly linked to one category.

Overall, the categorisation distinguishes between the different SNS relatively clearly and appears useful for analysing the link between nature situations and particular physical properties. However, it is important to note that the categorisation is specific to the data gathered and further research would be required to test whether it is applicable more widely.

Table 5. The co-occurrence of SNS qualities in the new categorisation of SNS.
Column: SNS qualities, Row: SNS categories. The number indicates the number of times the quality was coded in relation to the macro category.

	Restorative Experiences	Creative Experiences	Sensory Experiences	Physical Free Play	Nature School
Entertainment	14	138	73	177	30
Thought-provocation	13	8	46	7	106
Awe	2	0	39	0	30
Surprise	0	0	13	1	6
Intimacy	32	33	63	26	15
Mindfulness	33	74	51	2	14
Self-Restoration	113	16	6	0	7
Creative Expression	19	248	38	12	17
Physical Activity	0	16	7	227	12
Challenge	0	23	9	117	16
Engagement of Senses	25	19	215	12	16
Child-driven	70	228	188	199	23
Involvement of mentors	44	37	30	34	142
Structure/ Instructions	34	21	15	24	111
Social/Cultural Endorsement	3	2	19	3	55
Involvement of Animals	0	3	28	0	23

5.2 PHYSICAL PROPERTIES OF PEDAGOGICAL GREENSPACES

The observed school premises showed influences from the kindergarten movement with an emphasis on exploratory parts, creative free play and integration of nature through sandpits, vegetable boxes and fruit bushes. They also had elements from the adventure playground movement with loose structures designed to facilitate den making and readily available scrap materials such as wooden pallets, sticks and chipboard. Other areas also had elements from traditional playground design with swings, a slide or climbing apparatus. The nature reserves observed had fewer visibly designed elements but often included a ring of logs and non-permanent materials which could be taken down at the end of the day.

The area available for the children to use was negotiated verbally and by visual cues. In the school yards, a fence or wall signalled the boundary of where the children were allowed to play. Areas which different groups of children were allowed to use were divided internally via gates or verbal explanations. In the nature reserves and national parks, boundaries were marked by red or white ribbon tied to trees or by distinctive features of the landscape. For instance, a boundary could be understood as the area between a particular line of trees, the top of a hill and a large rock.

In the school that routinely utilised public land, time was spent at the beginning of every year teaching the children to recognise the boundaries of the area assigned to them by walking around the perimeter and pointing out the landscape features. When there was enough staff these areas could also be extended and new boundaries assigned.

Despite differences in the level of design and infrastructure mentioned in the case study section (p. 19-21), each of the observed spaces appeared to reflect the core values of the IUS pedagogy which emphasises the importance of outdoor child-led learning, adventure and play. The results show a similar number of significant nature situations (between 260 and 342) were recorded in each school. This suggests the conditions suitable for the affordance of significant nature situations can be various and diverse but may also rely on certain basic physical properties.

Of the total 945 nature situations reported, 38 physical properties were identified as important which were recorded 2,023 times. The number of physical properties recorded is significantly more than the number of nature situations as frequently multiple physical properties were observed in relation to each nature situation. The physical properties include: flat ground, uneven ground, loose ground, secluded space, open space, natural water sources, forest floor, grass lawn, meadow land, trails, rock formations, fauna, trees, logs, small stones, sticks, edible plants, non-edible plants, fungi and moss, undergrowth, rain water, native grasses, tree matter, arts and crafts materials, teaching materials, wilderness materials, building materials, sports equipment, sand, comfort enhancements, play props, collecting/ digging tools, shelter, fire put, waste disposal, play structures, wall/fence, table and/or benches (see Appendix 2 for a description of each property).

Only physical properties reported more than five times have been taken into consideration for the analysis.

In order to aid understanding of the diverse physical properties recorded, the properties are clustered into categories based on their similarity in terms of size, use and material composition: 'Landscape', 'Organic Material' and 'Artificial Material' (Figure, 7, 8 & 9). These categories do not aim to categorically describe all features of the environment, but rather to describe specific aspects that appeared to be important for the significant nature situations observed in this study. Below, I present the results of each category separately.

5.2.1 LANDSCAPE

'Landscape' is defined as the observed, permanent features of a particular area of land. There are 9 significant landscape features in this group: Flat Ground, Uneven Ground, Loose Ground, Open Space, Secluded Space, Rock Formations, Forest Floor, Trails and Natural Water source (See figure 10).

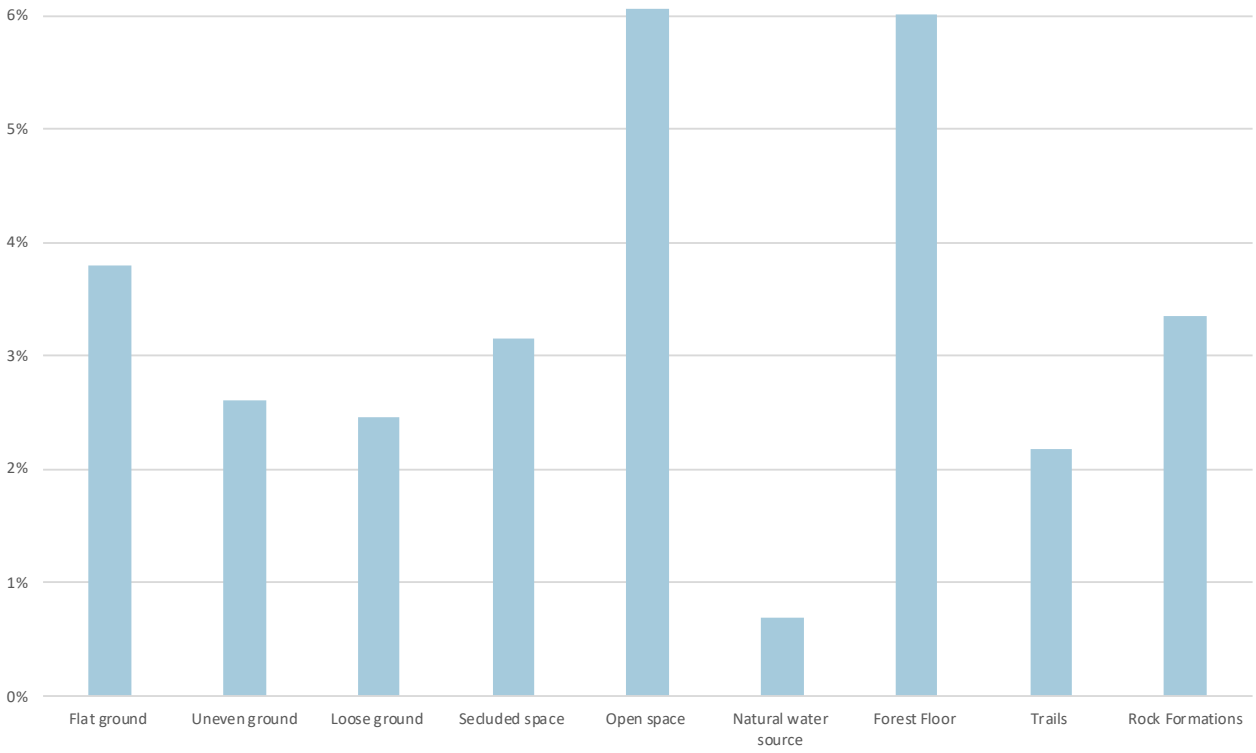

Fig. 10
Physical Attributes in the Landscape Category.
Vertical axis: Percentage of total amount of observed physical attributes. Horizontal axis: Landscape attributes

In the Landscape category, 'Open Space' and 'Forest Floor' were the most frequently recorded properties (123 and 122 recordings respectively). Open space can be seen to afford numerous possibilities, such as enabling groups to gather in the same place, affording physical movement and adding an element of safety (since all children can be seen). The forest floor also offers diverse possibilities in terms of thought-provocation, sensory experiences and comfort. Children were observed lying on the forest floor, picking berries, looking for insects and collecting leaves.

'Flat Ground', was the third most recorded category (77 recordings) and is often closely associated with open space. The combination of flat ground and open space appears to afford a range of activities including group

learning or crafts where children sit and work directly on the ground, as well as sports and physical activities.

'Natural Water Source' was the least recorded landscape property (14 recordings), this is likely due to the fact that none of the observed schools had a natural water source within their premise or within their most frequently visited nature area.

5.2.2 ORGANIC MATERIAL

'Organic Material' is defined as the flora and fauna specific to the geographical area as well as movable elements such as water and small stones. This category is made up of 12 properties: Fauna, Trees, Undergrowth, Logs, Small Stones, Sticks, Edible Plants, Non-edible Plants, Fungi and Moss, Tree Matter (including leaves, bark, pine needles and cones), Native Grasses and Rain Water (see figure 11).

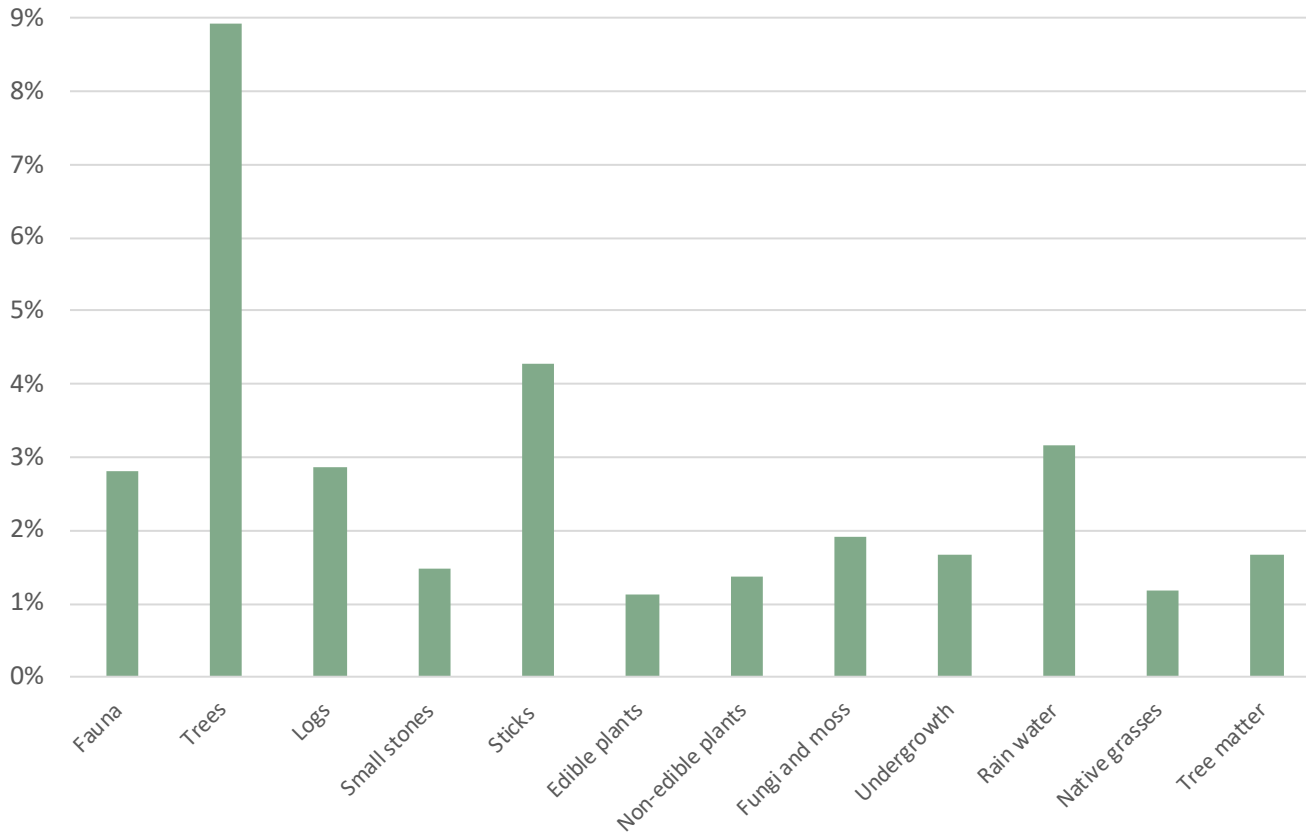

Fig. 11
Physical Attributes in the Organic Material Category.
Vertical axis: Percentage of total amount of observed physical attributes. Horizontal axis: Organic Materials

'Trees' were the most commonly recorded property overall (181 recordings). This is perhaps due to the diverse ways children interacted with trees in their environment. Trees afforded the possibility of rest, intimacy and shelter as well as the possibility for physical challenge in terms of climbing or balancing. They were also incorporated into creative den making and/or make-believe worlds.

Connected to trees, the second most recorded property was 'Sticks' (87 recordings). These elements were also frequently used in make believe games and den making. During the study, I observed sticks representing swords, magic wands, spoons, antlers, building materials, bartering goods, decoration, digging tools and more.

The least recorded items in the Organic Materials were 'Edible Plants' and 'Native Grasses' (23 and 24 recordings respectively). This appears to be mainly due to availability; edible plants were exclusively found in forest environments which were not visited every day. The forest areas that were frequently used by the children were worn down with use so did not have berry bushes or edible roots. The same applies for native grasses, which were not always present in the most frequently used areas. The second related factor is seasonal change. As the observations were conducted in Autumn, many areas which may have had grass in the summer had turned to mud. The availability of berries was also starting to decline during the study.

5.2.3 ARTIFICIAL MATERIAL

'Artificial Material' is defined as objects and structures recently brought to the area by human activity. This category is made up of 14 properties which can be sub-divided into fixed and loose parts. Artificial loose parts include: Art and Craft Materials, Teaching Materials. Wilderness Survival Materials, Building Materials, Sports Equipment, Sand, Comfort Enhancements (such as mats and blankets), Play Props (such as play cars, dolls and bricks) and Collecting/or Digging Tools. Artificial fixed parts include: Shelters, Fire Pit, Waste Disposal (including bin bags and compost bins), Play Structures (such as climbing frames, balance ropes and sandpits), and Tables and/or Benches (see figure 12).

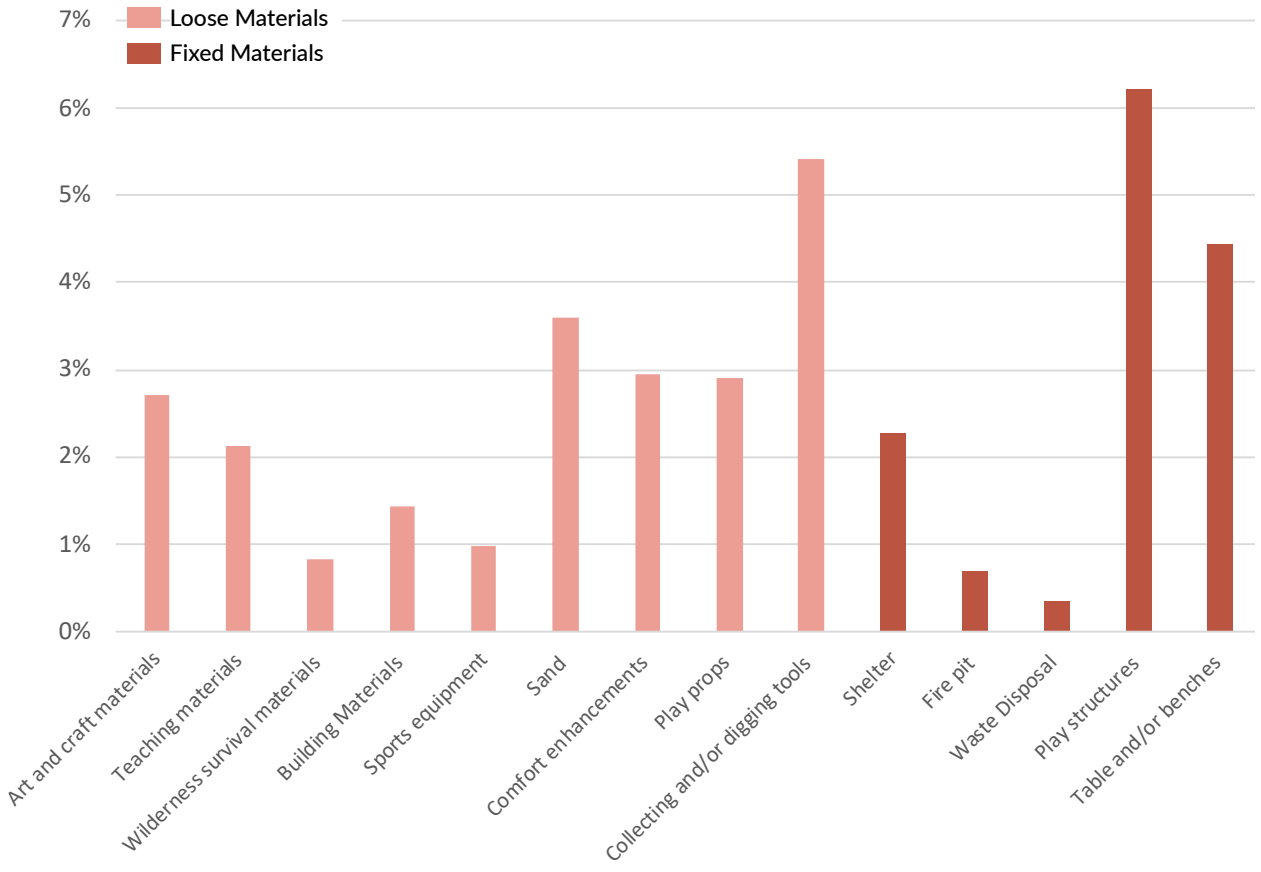

Fig. 12 Physical Attributes in the Artificial Material Category.

Vertical axis: Percentage of total amount of total amount of observed physical attributes. Horizontal axis: Artificial Materials.

Despite being an inherently organic material, sand is included in the artificial material category as, in the majority of cases, it was brought to the area as part of a sandpit and did not occur naturally.

In terms of loose artificial materials, 'Collecting and/or Digging tools' were the most frequently observed (110 recordings). These were most often observed in relation to sandpits but were also used to dig in loose, muddy areas and to collect small insects, flowers or leaves. The act of digging and collecting appeared to be popular with children in all three schools.

The least observed material was 'Wilderness Survival Materials' (17 recordings) due to the fact that wilderness activities were a rather rare and special occurrence which required adult supervision. The most commonly observed wilderness activity was whittling sticks with a knife or vegetable peeler.

The most commonly observed fixed artificial material was 'Play Structures' (126 recordings), followed by 'Tables and/or Benches' (90 recordings). The category 'Tables and/or Benches' were often used during lunch, arts and crafts activities and for building with bricks. Play structures such as slides, swings, sandpits and climbing bars were usually found in the more traditional play areas within the school premises. Whereas 'DIY' structures such as balance ropes tied between trees, shelters and building frames could also be found within forest areas and nature reserves.

The least observed fixed material was 'Waste Disposal' (7 recordings) perhaps due to their rather specific purpose. Items such as compost bins were sometimes used after snack breaks to teach children about recycling.

5.3 PHYSICAL PROPERTIES AND SIGNIFICANT NATURE SITUATIONS

In this section I will first, examine the most and least important physical properties for each of the SNS categories individually. Second, I will consider synergies and trade-offs between the physical properties of the SNS categories.

5.3.1 PHYSICAL PROPERTIES OF RESTORATIVE EXPERIENCES

Of the 113 'Restorative Experiences' recorded; 236 physical properties were observed. 90 of these related to properties within the landscape category, 54 within the organic category and 92 within the artificial category (see figure 13).

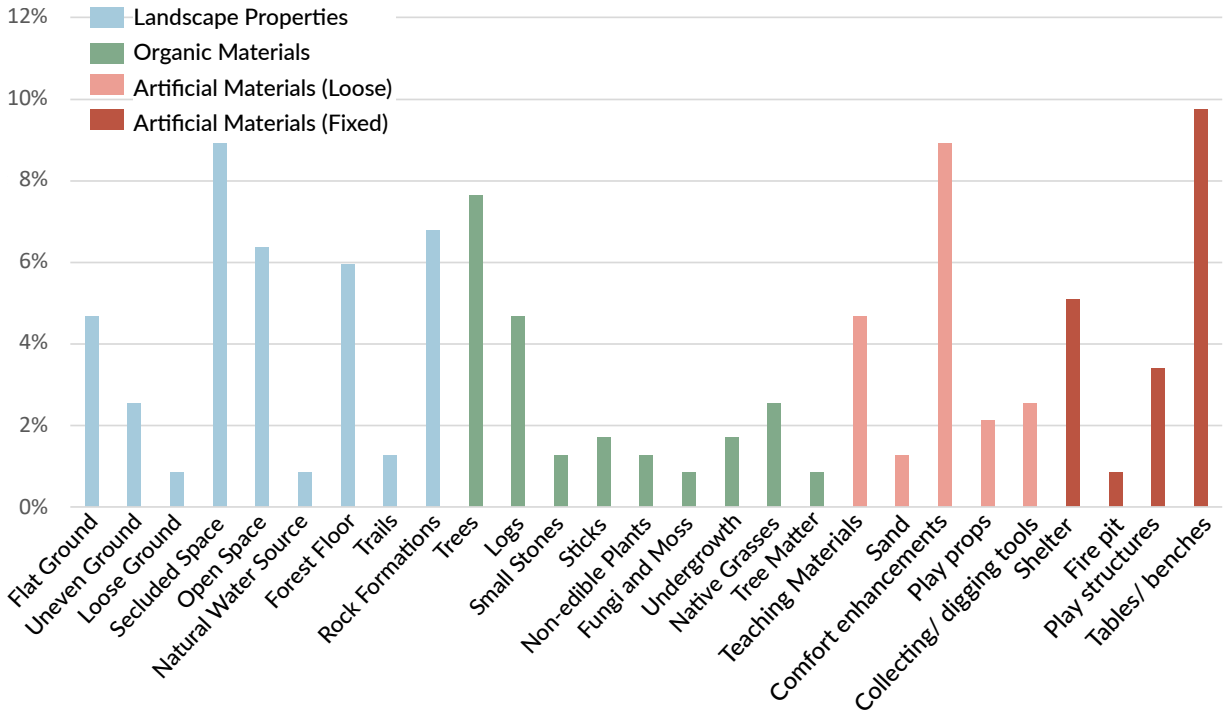

Fig. 13
Physical properties of Restorative Experiences.
The chart shows the properties of the physical environment on the horizontal axis and the percentage of total no. of physical property recorded for Restorative Experiences on the vertical axis.

LANDSCAPE

In terms of landscape, 'Secluded Space' is the most important physical attribute for restorative experiences with 21 recordings. 'Rock Formations', (16 recordings), 'Open Space' (15 recordings) and 'Flat Ground' (11 recordings), were also found to be fairly important while the presence of 'Loose Ground', 'Uneven Ground' and 'Natural Water Source' were seldom recorded (6 or less recordings).

The presence or ability for children to create 'Secluded Space' appeared important for different restorative experiences. Small secluded spaces, such as the stick tipi in figure 14, created the potential for children to be alone or in small groups away from the buzz of the rest of the children. This was considered conducive to rest and created a sense of security.

Larger secluded spaces, such as the ring of logs photographed in fig. 15, also allowed for restorative experiences because it was positioned in the upper corner of the school yard, shielded from the sight or sound

of the rest of the school. This particular space was frequently used by a group of 4-5 year-olds for story time after lunch. Thanks to its semi-secluded position, they were not disturbed by the older children who simultaneously used the rest of the school yard for free play time.

Fig. 14 & 15

Examples of secluded space. Left: Tipi in forest Right: Top corner of school yard with benches & surrounding trees.

Photo: Abigail Garbett October, 2019.

'Open Space' was also an important quality of natural environments that enabled restorative situations involving larger groups of children. Restorative group experiences, such as sitting in a ring and eating lunch, were often mediated by adults and rarely initiated by children themselves. 'Flat Ground' can also be seen to be fairly important for this type of restorative group experience.

ORGANIC MATERIALS

In terms of organic material, 'Trees' (16 recordings), 'Logs' (11 recordings) and 'Native Grasses' (6 recordings) are the most important while other materials were seldom recorded (less than 5 recordings).

Trees played an important role in forming secluded areas by creating shelter and obscuring the view of others. For instance, children played make believe behind the trunk of a tree or rested within the bow of a low tree obscured by leaves and branches. Logs were used as benches for children to sit on and as a result, were frequently used during story time or other restful activities. Occasionally, logs were also used in den making. By stacking them together or resting loose planks on top of them, they could create a restful place that was secluded from other activities.

While 'Native Grasses' was one of the least recorded elements in the organic material category, it was recorded in relation to 'Restorative Experiences' fairly frequently (6 out of 24 recordings). These were recorded when children were observed mindfully collecting grasses during walks or when they lay down to rest in grassy areas. As the majority of nature areas visited were part of a forest environment with a moss and leaf covered ground or school yard with loose dirt, the children did not encounter native grasses very often. Perhaps if native grasses were more frequently available, they would play a larger role in restorative nature experiences.

With the exception of the properties mentioned above, organic materials were rarely observed in relation to 'Restorative Experiences'. This may

be because 'Restorative Experiences' tend to be passive and rely on materials that provide comfort or shelter rather than loose organic parts like leaf matter, small stones or sticks.

ARTIFICIAL MATERIALS

'Comfort enhancements' was the most recorded artificial loose material (21 recordings) followed by 'Teaching Materials' (11 recordings). Significant fixed artificial materials include 'Tables and/or Benches' (12 recordings), 'Shelter' (12 recordings) and 'Play Structures' (8 recordings).

Comfort enhancements such as sit mats or blankets provided shelter from the elements which allowed children to feel comfortable within the outdoor environment. These were used during quiet, seated activities where the children had chance to rest from physical exertion.

In each observed school there was a sheltered quiet area where the children could rest and relax. These areas took different forms. In one school it was tarpaulin tied between trees, with a waterproof sheet and yoga mats and blankets underneath (see figure 16). In another school, it was a more permanent small wooden shelter with benches and cushions within the school yard (see figure 17). Sheltered areas were used most often by the preschool children who had time for rest structured into their afternoon schedule.

Fig. 16 & 17
Examples of comfort enhancements.

Left: Temporary tarpaulin structure with mats and blankets

Right: Sofa under shelter of school veranda.

Photo: Abigail Garbett October, 2019.

Books were the only form of teaching material associated with this category and were frequently used by teachers during story time and also by the children themselves during free play sessions.

Tables and benches were often used during quiet play activities such as building with bricks or tiles. During these quiet activities children often played mindfully alone or in twos or threes. This appeared to allow rest from physical exercise as well as social pressure.

'Play structures' that were occasionally linked to 'Restorative Experiences' include hammocks, sandpits and outdoor play kitchens. Outdoor play kitchens are defined as child-sized structures often placed next to sandpits with kitchen-like features such as an oven, cupboards, a sink or sideboard to be used for make-believe play (see figure 18). Outdoor play kitchens were seen to be particularly important for situations that offered relief

from gender stereotypes since all children were able to play and engage with traditionally female domestic tasks.

Fig. 18
Example of outdoor kitchen.
Photo: Abigail Garbett October, 2019.

Overall, properties from each of the three physical property categories appear important for creating safe and comfortable conditions needed for 'Restorative Experiences'. These include: 'Secluded Space', 'Rock Formations', 'Trees', 'Comfort Enhancements' and 'Table and or Benches'. While less often recorded, the presence of 'native grasses' also appeared to have restorative qualities.

5.3.2 PHYSICAL ATTRIBUTES OF CREATIVE EXPERIENCES

Of the 248 'Creative Experiences' recorded; 542 physical properties were observed. 127 of these related to properties within the landscape category, 290 within the organic category and 268 within the artificial category (see figure 19).

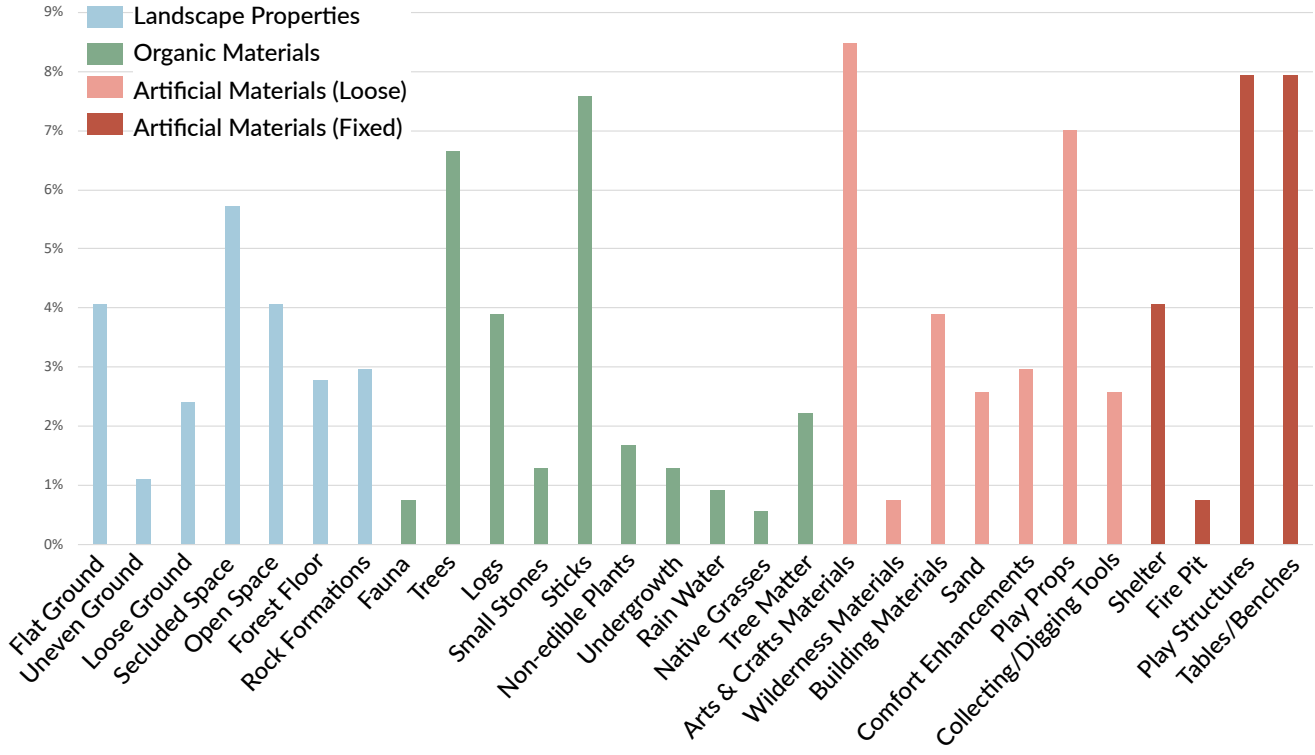

Fig. 19 Physical properties of Creative Experiences.
The chart shows the properties of the physical environment on the horizontal axis and the percentage of total no. of physical property recorded for Creative Experiences on the vertical axis.

LANDSCAPE

In terms of landscape, the most important attribute for creative experiences appears to be 'Secluded Space' (33 recordings), followed by 'Flat Ground' and 'Rock Formations' (each with 22 recordings). The presence of a 'Natural Water Source', 'Trails' and 'Uneven Ground' were recorded 6 times or less.

The importance of secluded space links most strongly to make believe play situations. In these instances, the children were observed in places away from adults, although, on occasion adults would be brought into the play situation for example, to 'taste' mud pies. Secluded spaces that promote make believe play are similar to the secluded spaces described in the 'Restorative Experiences' section but could also include child-sized play structures such as playhouses which create a sense of privacy within creative play experiences. These can be seen as child-only spaces since their small size makes them fairly inaccessible to adults.

'Flat ground' and 'Rock Formations' were observed in connection to a range of creative activities including singing, dancing, arts and crafts. Large flat rocks were often used for the purpose of craft activities or as a stage for song and dance performances.

For singing and dancing, the need for flat ground and open space is rather self-explanatory, especially for groups of children. On one occasion I watched a singing performance by three girls. They created the performance for the school to watch during after school free time (fritidsklubbar). The performance took place in a clearing in the forested part of the school yard. They used logs to stand on and arranged their audience in the open space in front of them.

For outdoor arts and craft activities, children were often observed working directly on the ground (see figure 20 & 21). As a result, a flat surface and space to spread out materials can be seen to be desirable. On one occasion I accompanied a class into the forest where they made autumnal pictures from leaves they collected in the area. In this instance the only artificial materials available to them was paper and sticky tape.

Fig. 20 & 21 Examples of outdoor artistic activities.
Photo: Abigail Garbett, October, 2019.

ORGANIC MATERIALS

The most important organic material for creative experiences was 'Sticks' (41 recordings), followed by 'Trees' (36 recordings), 'Logs' (21 recordings), 'Tree Matter' (12 recordings) and 'Non-edible Plants' (9 recordings). All other properties were recorded 7 or less times.

The importance of sticks relates most strongly to the activity of den making which was a popular activity both in the forest and school yard. Small sticks and tree matter also played an important role in creating make believe worlds (see figure 22 & 23). Loose tree matter and non-edible plants were observed in craft activities such as making autumn pictures or 'homes' for snails. The availability of plants and leaves of differing shapes and colours appeared to be important, particularly for artistic activities.

One teacher explained to me that the children in her class had on their own initiative, created an imaginary society in a nature reserve which they visit every few weeks. In this nature reserve, they had created shops/ services and exchanged different goods such as sticks, berries or stones with one and another. This area was particularly rich in biodiversity which gave the children the opportunity to collect many different types of organic material.

Fig. 22 & 23

Left: Example of creative play with sticks and tree matter.

Right: Example of den making with sticks.

Photo: Abigail Garbett October, 2019.

Similar to 'Restorative Experiences', 'Logs' were also highly recorded organic materials and were primarily used to sit on. The presence of logs is linked most often to craft activities that children engage with while sitting, though logs were also sometimes used in den making.

ARTIFICIAL MATERIALS

Loose artificial materials that recorded highly for 'Creative Experiences' include 'Arts and Craft Materials' (46 recordings), 'Play Props' (38 recordings) and 'Building Materials' (21 recordings). With regards to fixed artificial materials, 'Play structures' (43 recordings), 'Table/ Benches' (43 recordings) 'Shelter' (22 recordings) were the most important.

The importance of art and craft materials, tables, benches and shelter are fairly self-explanatory since many creative activities such as drawing, sewing or building with bricks took place on tables in semi-sheltered areas. The presence of tables seems particularly helpful for arts and craft activities that required adult supervision such as sewing since the adult

could easily see and assist the children involved. However, as mentioned in the organic materials section, they were not always used and the children I observed also appeared happy to work directly on the ground.

Larger building materials such as planks of wood and pallet board were mainly used for den making. In one school yard there were two wooden grid-like structures which the children used to build dens in and around (see figure 24 & 25). Here I observed children collecting planks and pallet board and slotting them in the existing structure. This allowed the children to shape the look and size of their den and fulfilled a similar function to a network of branches within forested area. These were very well used and seemed to be a good method to promote creative experiences in areas with less natural structures (such as trees) to build around.

Fig. 24 & 25
Examples of structures used for den making.
Photo: Abigail Garbett October, 2019.

The play props associated with this category include a variety of toys such as small building bricks, play food items and dolls. The most commonly observed play prop was building bricks and in only one school were props such as dolls or play food items observed.

The necessity of artificial play props was discussed by the teachers. In the school that used the least artificial materials, a teacher explained to me that she didn't think children needed them because she observed how her students were capable of creating an infinite number of imaginary play episodes with the natural elements around them. In a different school, a teacher also told me that thanks to the abundance of natural elements, play involving sticks, leaves or mud involved less conflict and competition among the children in comparison to artificial play props which tended to be limited in number.

In addition to the den making structures mentioned above, play structures related to creative experiences include wooden forms such as boats or cars which promoted make-believe play and pop-up theatres. The wooden forms were used in two of the three schools and appeared to be distinctive places where the children often congregated of their own accord. They seemed to engage children in specific kinds of make-believe play, for instance, sailing on the sea or driving a car. However, the play episodes I observed were not particularly long or different from other forms of imaginary play, leading me to question the importance of such structures. More open-ended play with natural elements such as

tree trunks, sticks and undergrowth appeared to be more successful in enabling children to create their own narrative within the play situation.

Theatre was used on three occasions during my observations. In two instances, a play was performed by the staff for the children to watch within the school yard. In the third instance, a play was performed by the children in a temporary theatre fashioned from a shower curtain in the forest (see figure 26). The children were given props such as a tail, hat or pair of mouse ears and the story was narrated by the teacher. The performance was also filmed by the teacher and the children had the opportunity to watch it later in the day. The later example appeared to be the most engaging for the children involved and they expressed amazement in watching their own performance.

Fig. 26
Temporary theatre created with sheets.
Photo: Abigail Garbett October, 2019.

In summary, 'Creative Experiences' appear to be the most reliant on external physical properties with the highest number of recordings overall. In particular, properties within the artificial materials category, such as 'Arts Materials', 'Play Structures' and 'Tables and/or Benches' and landscape features, such as 'Secluded Space', recorded highly and can be seen to be enablers of outdoor-based creative experiences. While organic materials, such as 'Sticks' and 'Trees', and artificial 'Play Props' were frequently the subject or focus of creative experiences.

5.3.3 PHYSICAL ATTRIBUTES OF SENSORY EXPERIENCES

Of the 215 'Sensory Experiences' recorded, 487 physical prosperities were observed. 89 of these related to properties within the landscape category, 291 within the organic category and 205 within the artificial category (see figure 27).

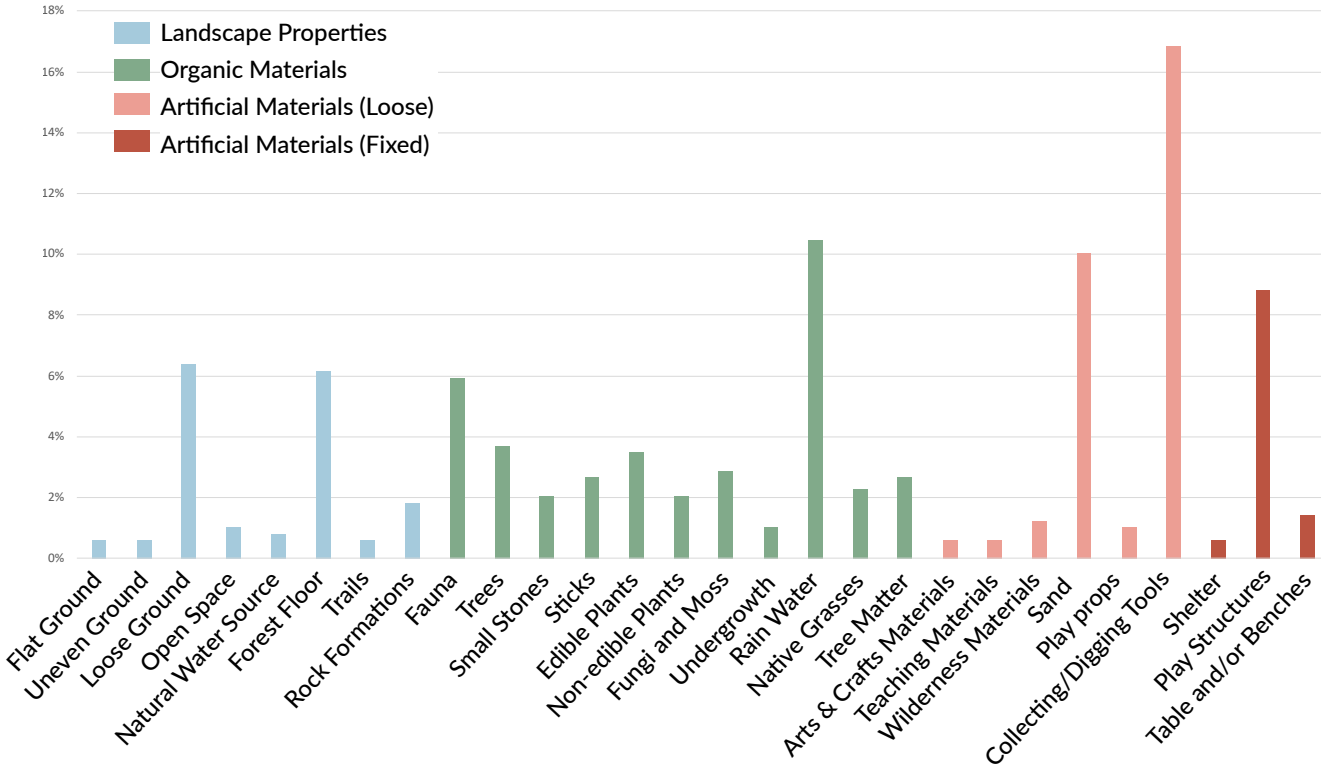

Fig. 27

Physical properties of Sensory Experiences.

The chart shows the properties of the physical environment on the horizontal axis and the percentage of total no. of physical property recorded for Sensory Experiences on the vertical axis.

LANDSCAPE

In terms of landscape, 'Loose Ground' (31 recordings) and 'Forest Floor' (30 recordings) were the most important property for sensory experiences. The least recorded elements include 'Trails', 'Flat Ground', 'Uneven Ground' and 'Secluded Space' (3 or less recordings). 'Natural Water Source' was recorded 4 out of 14 times in relation to 'Sensory Experiences'.

'Sensory Experiences' centred around environments where children could easily interact with loose parts that engaged the senses. As a result, it is unsurprising that loose ground and forest floor were the most important properties. Loose ground affords activities such as digging, building with mud and clay and finding insects and roots. Similarly, the diversity of the forest floor affords possibilities such as picking and tasting berries and plants, feeling different textures and collecting various small natural elements such as pine needles or leaves.

ORGANIC MATERIALS

In terms of organic material, 'Rain Water' (51 recordings), 'Fauna' (29 recordings), 'Trees' (18 recordings) and 'Edible Plants' (17 recordings) were the most frequently recorded, followed by 'Fungi and Moss' (14 recordings) 'Tree Matter' (13 recordings), 'Sticks' (13 recordings) and 'Native Grasses' (11 recordings). The least recorded element was 'Logs' (2 recordings).

In the observed schools, the presence of rain water was central to many sensory experiences and appeared to fascinate the children. They collected water from nearby drainpipes and puddles, created channels with it, mixed it with other natural elements such as mud or grass and splashed around in puddles. Given the interest in rainwater, it is likely that the landscape property 'Natural Water Source' would also afford many possibilities for sensory experiences if access was regularly available.

The types of fauna observed include snails, slugs, birds, snakes, ants, spiders, woodlice and one field mouse. Smaller creatures such as snails and woodlice were often found in the school yard by the children themselves. Once found, children would usually display signs of amazement when seeing or touching them and often incorporated the creatures into their play. For instance, on one occasion children discovered a mass of snails in their schoolyard and began to collect them and make homes for them in buckets with flowers and leaves (see figure 28).

Fig. 28
Child holding 'snail home' created with natural elements found in the school yard.
Photo: Abigail Garbett October, 2019.

Larger creatures such as snakes, mice and birds were found in forest environments and were often pointed out by teachers. These chance opportunities appeared to be thought provoking for the children and activated their sense of sight and hearing.

Another central element was edible plants which were recorded 17 out of 23 times in relation to 'Sensory Experiences'. In forest environments, children easily identified edible plants and berries which they appeared to enjoy gathering and tasting. The number of times edible plants were recorded was strongly dependent on seasonal factors and the diversity of the nature areas visited.

Materials such as grasses, leaves, moss, small stones and non-edible plants were also frequently collected by children for use in sensory projects such as potion making.

ARTIFICIAL MATERIALS

The most common artificial loose materials were 'Collecting and/or Digging Materials' (82 recordings), 'Sand' (49 recordings) and 'Play Structures' (43 recordings). Despite being a small category, 'Wilderness Survival Materials' were also commonly associated with 'Sensory Experiences' (6 out of 17 recordings). Other materials were recorded 5 or less times. 'Play

Structures' were the most important artificial material (43 recordings).

Collecting and digging tools such as spades, buckets and cups helped children to interact with organic materials such as sand, soil or mud and were often found in the school play area (see figure 29 & 30). For instance, where sand or mud was available children were frequently observed making mud pies with bucket and spades. However, in the absence of such tools, the observed children did not hesitate to improvise by moulding the mud or sand with their hands or by collecting berries or sticks by hand and storing them in their hat or pockets for instance.

Fig. 29 & 30

Examples of sensory play with mud and digging tools.

Photo: Abigail Garbett October, 2019.

Wilderness survival materials such as fire-lighting implements also scored highly in this category. On three occasions I observed mentors lighting a fire. On one occasion this was used to cook lunch for a group in the forest. On the other two occasions it was incorporated into a learning exercise. In all three instances watching a mentor light a fire appeared to be an awe-inspiring experience and the children remarked on the sight, smell and heat of the fire.

The two most commonly recorded play structures were sandpits and play kitchens which facilitated play around sand and mud. Play with sand and mud appeared to activate the children's senses in terms of touch and sight and were frequently linked to mindful play in which the child's attention was captured for long periods of time. Of the artificial materials recorded, the sandpit was perhaps the most useful since it cannot easily be naturally replicated in the observed areas and it appeared to be very popular in all three schools.

In summary, 'Sensory Experiences' appear to be most reliant on 'Collecting and/or Digging Tools', 'Sand' and 'Rain Water'. Although less frequently recorded, 'Natural Water Source', 'Edible Berries' and 'Fauna' also appear to be important for sensory experiences. Overall, properties in the 'Organic Materials' category were the most frequently recorded in relation to this category.

5.3.4 PHYSICAL ATTRIBUTES OF PHYSICAL FREE PLAY

Of the 227 'Physical Free Play' situations recorded; 417 physical properties were observed. 195 of these related to properties within the landscape category, 374 within the organic category and 66 within the artificial category (see figure 31).

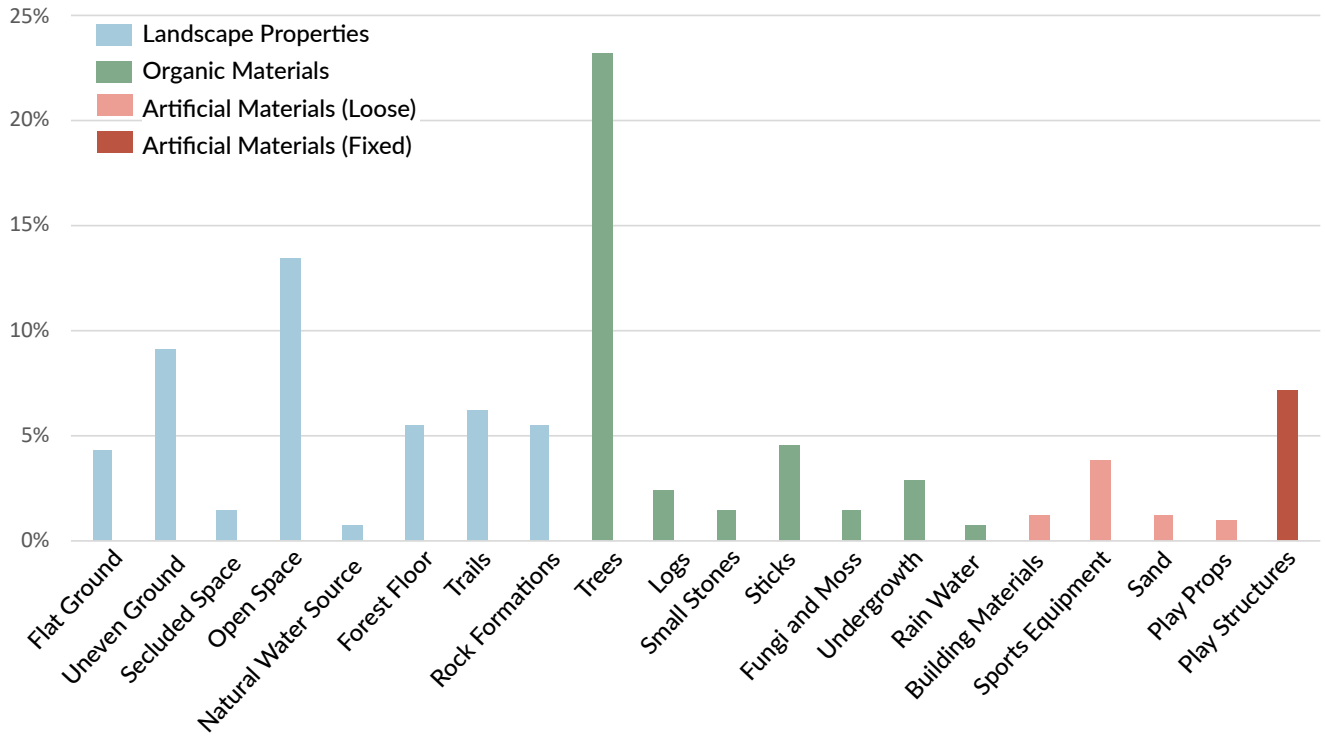

Fig. 31
Physical properties of physical free play.
The chart shows properties on the horizontal axis and number of recordings on the vertical axis.

LANDSCAPE

Physical free play was linked to several attributes in the landscape category. The most frequently recorded attributes were 'Open Space' (56 recordings) and 'Uneven Ground' (38 recordings), followed by 'Trails' (26 recordings), 'Rock formations' (23 recordings) and 'Forest Floor' (23 recordings). The least recorded properties were 'Secluded Space', 'Natural Water Source' and 'Loose Ground' (6 or less recordings).

Open space appeared to be important for sports such as football as well as many physical free-play activities. The combination of open space, uneven ground (in particular gentle slopes and hills), rock formations, and trees often featured in child-led play and supported imaginative physical play. In such areas, I observed children role playing as horses, wild animals, hunters and other characters.

In one nature area there was a fairly flat and open space (approximately, 36 x 27 meters) which was flanked on one side with a fairly steep slope and a softer slope on the opposite side. This is appeared to be a useful configuration because it allowed for activities requiring flat land such as ball games and opportunities for running and hiding from each other. There appeared to be something exhilarating about running down one slope and up another.

Trails were most often used for walking when activities took place outside the schoolyard. These walks usually involved instruction from a mentor or

teacher. The trails I observed were all fairly similar and usually consisted of a one-person wide dirt track. As they were found in nature areas away from traffic hazards, children could often walk freely and engage with observation games while they walked. Teachers often created games to keep the children entertained and encouraged them to notice specific features within the landscape as they walked.

'Loose Ground' and 'Natural Water Source' did not appear to be important for physical free play during the time period. Though, in warmer months when swimming is possible, natural water sources could provide an opportunity for swimming. Loose ground on the other hand was often associated with more passive activities and thus does not seem to be particularly important for physical play.

ORGANIC MATERIALS

In terms of organic material, the presence of trees is clearly the most important attribute with 97 recordings, followed by 'Sticks' (19 recordings), 'Undergrowth' (12 recordings) and 'logs' (10 recordings). All other materials were recorded 6 times or less.

Trees were often used for climbing and balancing purposes and as hiding places in active child-led games like chase. In all three schools, children were observed climbing in living trees. Trees that were good for climbing tended to be strong but quite small and with many branches. Quite often these were relatively young spruce trees.

Tree climbing was managed in different ways. In one school, the children were told which trees they were allowed to climb while in another school children were allowed to climb all trees but no more than three children were allowed to climb the same tree at one time. These measures helped to ensure the safety of the children as well as attempting to protect the health of the trees themselves. Dead, fallen trees were also often incorporated into play episodes and were commonly used for balancing.

Sticks and undergrowth were often used for more physical den building activities which in some instances occurred within the trees themselves. For instance, on several occasions and in all three schools I observed children collecting sticks and placing them on branches or within areas with a lot of undergrowth to create a secluded area or den.

Aside from 'Trees', organic materials were seldom recorded in relation to 'Physical Free Play'. This may be due to the fact that physical free play is rarely associated with 'loose parts' such as leaves, grasses and small plants that may support more mindful, creative or sensory play. Instead, properties that support physical movement such as running, jumping, climbing, balancing or walking tend to involve more fixed or permanent features of the landscape such as open space, slopes or trees.

ARTIFICIAL MATERIALS

Both loose and fixed artificial materials were rarely recorded in relation to physical free play with the exception of 'Play structures' (30 recordings) and 'Sports Equipment' (16 recordings).

Sports equipment was a relatively small category with only 20 observations. The most common equipment was a ball, though bandy sticks and goal posts were also observed in one school. Most of the time, sports activities were reserved for sports lessons which took place in non-natural environments such as a public sports hall or an artificial turf sportsfield.

The types of play structure associated with physical free play included traditional structures such as swings, slides and climbing frames. These traditional structures were found in the two school yards observed as well as the pubic playground used by school 2. In the observed nature areas there were also play structures that were integrated into nature. For example, a balance rope tied between two trees in a forest area or a climbing structure made from rope and branches (see Figure 32 & 33).

Fig. 32 & 33
Examples of trees being used for physical free play.
Left: Tree used for climbing plus rope used to create temporary swing.
Right: Balance rope tied between trees.
Photo: Abigail Garbett October, 2019.

In summary, 'Physical Free Play' appeared to be the least reliant on artificial materials and 'Trees' was clearly the most important physical property overall. Several landscape properties including 'Open Space' and 'Uneven Ground' were also important for creating the conditions necessary for different types physical free play.

5.3.5 PHYSICAL ATTRIBUTES OF NATURE SCHOOL

Of the 142 'Nature School' situations recorded 324 physical properties were observed. 106 of these related to properties within the landscape category, 215 within the organic category and 113 within the artificial category (see figure 34).

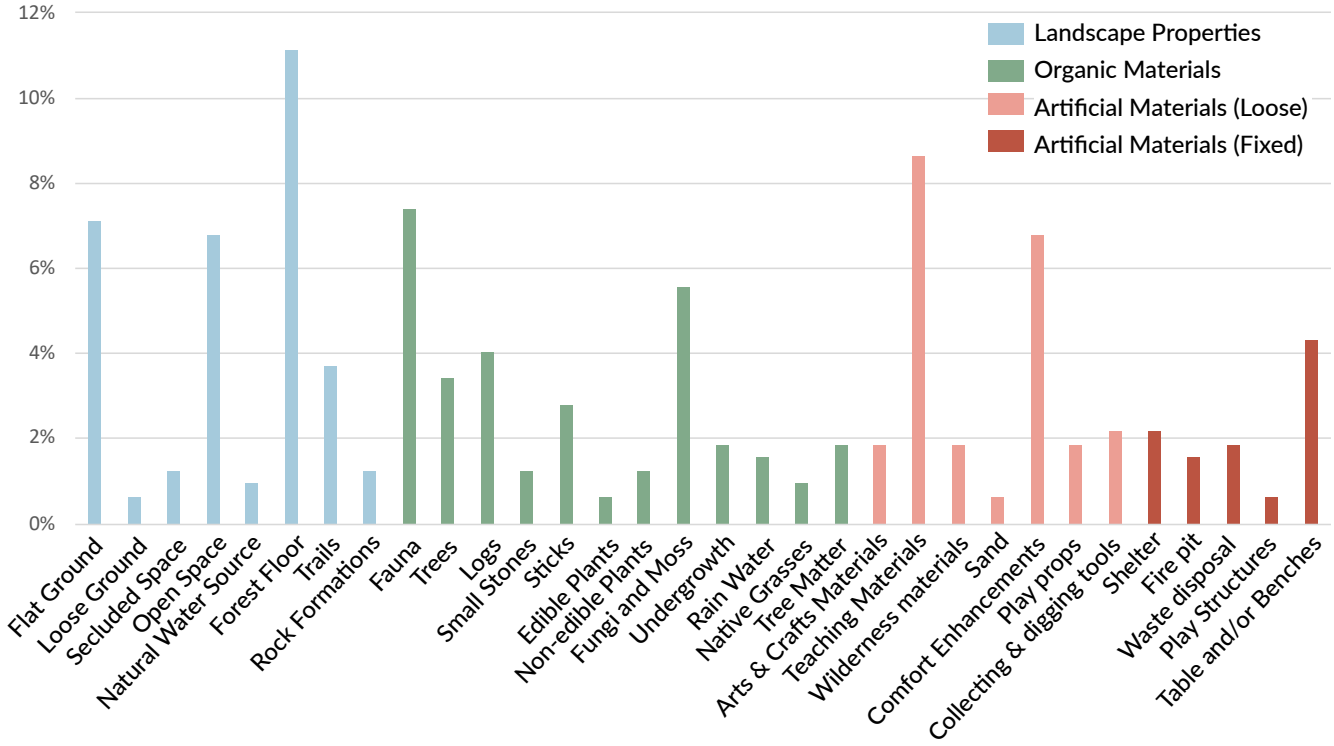

Fig. 34

Physical properties of nature school.

The chart shows properties on the horizontal axis and number of recordings on the vertical axis.

LANDSCAPE

In terms of landscape, the 'Forest Floor' (36 recordings), 'Flat Ground' (23 recordings) and 'Open Space' (22 recordings) are the most important physical attributes for nature school activities, followed by 'Trails'. All other properties were recorded 4 times or less.

In the absence of tables, flat ground and the forest floor (often a combination of both) were used as the basis for nature school activities. Teaching materials would often be arranged on the floor or attached to natural elements such as trees (see figures 35 - 37). Open space in the form of a forest clearing for instance, was also used for active learning situations. For example, one Swedish lesson involved throwing a ball in a ring while stating describing words.

Nature school activities took place in various places. On one occasion I visited a lake with a school class. On this occaision, children collected small beetles and insects from the lake and studied them under a microscope.

I also observed an outdoor maths lesson in which maths exercises were printed on small pieces of paper and pegged to different natural elements such as trees and bushes. The children then had to go around and find these, complete the exercise and return it to the teacher.

One teacher commented on the need for more space for different classes to hold outdoor lessons at the same time. At the school in question, there had been an increase in the number of enrolled children but no increase in the size of the schoolyard. This meant that it was difficult to hold outdoor sessions within the school premises without being disturbed by one of the other groups.

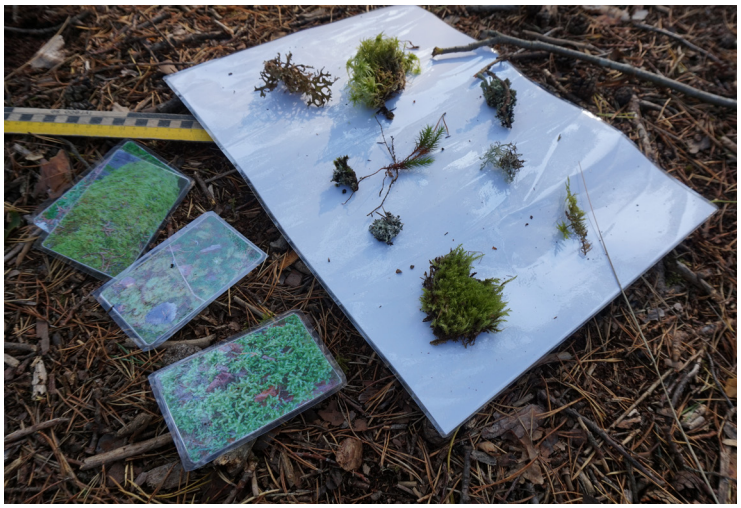

Fig. 35, 36 & 37
Examples of nature school activities.
Photo: Abigail Garbett October, 2019.

ORGANIC MATERIALS

In terms of organic materials, 'Nature School' was closely associated with 'Fauna' (24 recordings), 'Fungi and Moss' (18 recordings), 'Logs' (13) and 'Trees' (11 recordings). All other properties were recorded 9 times or less.

Fauna, fungi and moss were often used directly as the subject of learning situations. For instance, during a day spent in a nearby nature reserve the teacher formed a lesson plan around discovering and identifying different types of lichen and fungi growing in the area. Similarly, in a different school, when children found an abundance of snails in the playground, the teacher created a lesson around different types of local snails involving racing, drawing, naming and reading about them.

According to one teacher, a key motivation for visiting different nature reserves is the possibility to see different wild animals and their habitats. For instance, the teacher explained to me how discovering an animal habitat such as a beaver dam can provide multiple learning opportunities which can be incorporated in the curriculum.

Rather than being the subject of the learning situations, logs were commonly used to support learning situations as objects to sit on. As previously mentioned, in the absence of logs children readily sat on mats on the ground. However, logs can be seen to be useful in rainy weather when the ground may be too waterlogged to sit on directly.

All of the observed schools had areas reserved for gardening which were used during certain times of the year (see figures 38 & 39). In one school a teacher informed me that the produce from the garden boxes would be used by the school kitchen to prepare meals for the children. On one occasion, I observed the children collecting seeds, ready to be planted in the spring. If the research were to continue in Spring, it is likely that more gardening activities would be observed.

Fig. 38 & 39
Examples of gardening projects in school yards.
Photo: Abigail Garbett October, 2019.

ARTIFICIAL MATERIALS

Unsurprisingly 'Teaching Materials' such as, books, picture and information cards, dice, number grids, microscopes and gardening materials were most important for 'Nature School' (28 recordings), followed by 'Comfort Enhancements' (22 recordings) and 'Table and Benches' (14 recordings). Comparatively, 'Wilderness Survival Materials' (6 out of 17 recordings) and 'Waste Disposal' items (6 out of 7 recordings) were also important.

'Fire pits' and 'Wilderness Survival Materials' such as wood, matches and knives were also observed during activities such as supervised preparation of food to cook outdoors. Comfort enhancements, largely in the form of sit mats were also commonly recorded with this category. These were used during more passive teaching activities when the children would sit on logs or on the floor for longer periods of time.

Perhaps surprisingly, tables and benches were recorded less frequently in relation to 'Nature School' than to 'Creative Experiences' or 'Restorative Experiences' categories. This may partly be because nature school situations frequently occurred outside the school yard in forest environments where tables and benches were not available and partly because the educational process is not linked to stationary activities, but to authentic experiences based on the ever-changing physical properties of the environment.

Though rarely observed, 'Waste Disposal' items were commonly associated with this category. Teachers often used the act of collecting rubbish in the forest or composting fruit peel after a snack break as a teaching opportunity. This created a positive reinforcement around taking care of nature and recycling.

Overall, 'Nature School' is perhaps the hardest SNS to categorise in terms of physical and environmental attributes because the content of nature school activities is likely to change depending on the goals of the teacher/mentor. For instance, the reason 'fungi and moss' appear important for 'Nature School' was largely influenced by the fact that a lesson about fungi and moss was observed. If another lesson was observed about edible plants, perhaps they would appear to be the most important. However, more broadly the high number of recordings for 'Forest Floor' and for several organic materials including 'Fauna' suggest that environmental variation and high-levels of biodiversity are important factors for nature school activities.

5.3.6 SYNERGIES AND TRADE-OFFS BETWEEN THE PHYSICAL PROPERTIES OF SNS

The results suggest that SNS categories share complementary and contrasting physical properties. Certain physical properties are recorded highly in relation to multiple SNS while others are more specifically linked to a single category. For example, in the Landscape category, 'Open Space' is important for 'Physical Free Play' (56 recordings), 'Creative Experiences' (22 recordings) 'Nature School' (22 recordings) and 'Restorative Experiences' (15 recordings). Similarly, 'Flat Ground' is important for 'Nature School' (23 recordings) and 'Creative Experiences' (22 recordings) and fairly important for 'Physical Free Play' (18 recordings) and 'Restorative Experiences' (11 recordings). 'Restorative' and 'Creative Experiences' in particular share several of the same properties within the landscape category, for instance, 'Secluded Space' (21 and 31 recordings respectively), 'Forest Floor' (14 and 15 recordings) and 'Rock Formations' (recorded 16 times for both categories).

In the organic material category, 'Trees' are important for 'Physical Free Play' (97 recordings), 'Creative Experiences' (36 recordings), 'Restorative Experiences' (18 recordings), 'Sensory Experiences' (18 recordings) and to some extent Nature School (11 recordings). Likewise 'Logs' are fairly important for 'Creative Experiences' (21 recordings), 'Nature School' (13 recordings), 'Restorative Experiences' (11 recordings), 'Physical Free Play' (10) but are not important for 'Sensory Experience' (2). In the artificial material category, 'Comfort Enhancements' are fairly important for 'Nature School' (22 recordings), 'Restorative Experiences' (21 recordings) and 'Creative Experiences' (16 recordings). Similarly, 'Play Structures' are important for 'Creative Experiences' (43 recordings), 'Sensory Experiences' (43 recordings) and 'Physical Free Play' (30 recordings).

The importance of certain physical properties for two or more SNS categories suggests that synergies can be developed in the way designers or city planners combine physical properties. This can be further informed by consideration of properties that are important for singular categories.

For example ‘Loose Ground’ is important for ‘Sensory Experiences’ (31 recordings) but not for ‘Creative Experiences’ (13 recordings), ‘Restorative Experiences’, ‘Physical Free Play’ or ‘Nature School’ (2 recordings for each category). This indicates a potential trade-off, since ‘Loose Ground’ cannot occur in the same place as ‘Native Grasses’ or the ‘Forest Floor’ although, they can all make up parts of a larger area. Determining whether to include ‘Loose Ground’, ‘Native Grasses’ or the ‘Forest Floor’ could thus be informed by whether the area aims to encourage Sensory Experiences or one of the other categories. On the other hand, if ‘Loose Ground’, ‘Native Grasses’ and ‘Forest Floor’ can be included within the same design plan, this information could be useful in determining where these areas should be located and in relation to which other physical properties.

Rain water is also important for ‘Sensory Experiences’ (51 recordings) but not in relation to the other categories (5 or less recordings). While the presence of rain water does not necessarily conflict with the other physical properties, the way rain water is collected could be directed to an area that is specifically designed for ‘Sensory Experiences’, thus increasing the likelihood of sensory SNS occurring there.

The position of artificial materials that are particular for certain SNS, such as ‘Collecting and/or Digging Tools’ which are important for ‘Sensory Experiences’ (82 recordings) but not for the other categories (14 or less recordings) or ‘Arts and Crafts Materials’ which are recorded 46 times in relation to ‘Creative Experiences’ but less that 6 times in relation to other categories, could also be optimised. For instance, by grouping arts materials with other physical properties important for ‘Creative Experiences’ such as ‘Tables/or Benches’ (43 recordings) and ‘Secluded Space’ (31 recordings) an area could be created specifically for creative nature experiences.

By designing pedagogical greenspaces that work with these similarities and differences there is potential to maximise support for various significant nature situations within the same area or alternatively to design areas specifically focused on one or more SNS group.

6 DISCUSSION

Fig. 40
Autumn picture making.
Photo: Abigail Garbett October, 2019.

The aim of the thesis was to explore how the spatial configuration of pedagogical greens spaces can enhance children's HNC. In this chapter I will first discuss the design and use of pedagogical greenspaces through four key stages: 'The most and least important physical properties', 'Balancing the need for space and place making', 'Utilisation of the SNS categorisation in the design and planning process' and 'Combinations of materials and landscapes'. This is followed by an exploration of the potential for design in creating social-ecological cities. Finally, the limitations of the study and possibilities for future research will be discussed.

6.1 DESIGN FOR URBAN PEDAGOGICAL GREENSPACES

6.1.1. THE MOST AND LEAST IMPORTANT PHYSICAL PROPERTIES

A central purpose of this thesis was to identify the physical attributes of spaces that nurture children's connection to nature. Using the qualities of SNS as defined by Giusti et al. (2018) as a basis, the case study aimed to determine the importance of different physical elements based on the number of times they were observed as part of SNS.

Overall, the most important physical property were trees. As discussed in the results section, trees offer multiple play and learning possibilities and though they appeared most important for physical free play, they were recorded fairly highly in relation to all five SNS categories. In addition to functional forms of play, such as climbing, trees provide 'loose parts' such as sticks and leaves which afford creative and constructive forms of play (Nicholson, 2009). The importance of organic loose-parts is illustrated in the results that show that 'sticks' was the most recorded organic material for 'Creative Experiences' and that 'Tree Matter' was fairly frequently recorded in relation to both 'Creative Experiences' and 'Sensory Experiences'.

The results also show that dead trees afford opportunities for diverse SNS including balancing, den making and observing insects. As a result, it appears that any greenspace aiming to promote HNC should not only include trees but allow them to degrade naturally. In practice this means leaving leaves to rot and fallen branches to lie on the ground etc. regardless of how they look aesthetically.

The importance of allowing ecosystems to decay naturally supports the need outlined by Samborski (2019) to move away from adult priorities of 'neatness' and risk management emphasised in traditional playground design. By allowing urban greenspaces to be more wild and 'messy', it is possible to simultaneously make them more attractive to children (since the possibility to shape their environment is increased by the presence of loose parts) and to increase biodiversity.

The least recorded organic materials were 'edible plants' and 'native grasses'. The reason for the low number of recordings appears to be a lack of opportunity rather than a lack of importance. For instance, 'Edible Plants' appeared important for 'Sensory Experiences' and children showed enjoyment in finding and eating them. However, these were seldom found, partly because of seasonal changes but also because they didn't grow in areas frequently used by the children.

Similarly, native grasses appeared to be an important property for 'Restorative Experiences' as long grass provided a comfort and a sense of seclusion when resting on the ground. However, native grasses also tended not to grow in many of the areas of frequent use because the ground had become hard and compact (see figure 41 & 42).

Fig. 41 & 42
Examples school yards showing signs of overuse.
Photo: Abigail Garbett October, 2019.

6.1.2 BALANCING THE NEED FOR SPACE AND PLACE MAKING

The capability of the land to afford meaningful SNS was further highlighted by the need to maintain organic materials in areas of frequent use. For instance, a teacher informed me that as the children often play with sticks (and sometimes take them home), the amount of sticks available slowly decreases. As a result, they occasionally have to go and retrieve more sticks from the surrounding forest. This raises questions of the long-term sustainability of the pedagogical greenspaces in question.

The size of greenspaces is consequently an important factor and consideration should be taken in urban planning to determine how many children/how much use, an area of land and connecting ecosystems can support, while still maintaining high levels of biodiversity and resilience. The issue of over-use and land degradation links to wider concerns over the 'recreational capacity' of nature reserves in Sweden (Szczepanski, 2001) and the United Nations aim to promote 'heathy lifestyles in harmony with nature' which cannot be met without the prioritisation of large urban greenspaces (United Nations, 2017). However, in the design of pedagogical greenspace specifically, safety is also an important factor.

If children are given too large an area to use it may become difficult to keep track of them without increasing the amount of adult supervision needed, even though more space may increase the ecological resilience of the area overall. The problem could be solved by utilising greenspaces on a rotatory basis, in a similar way to the rotation of crop land or grazing pasture. However, according to several of the teachers I spoke to, repeat experience of the same area of land is an important factor for the development of HNC. This is supported by research on the role of place attachment in the development of HNC and a sense of stewardship over ecosystems (Masterson et al., 2017).

When estimating how much land is required to enhance HNC, it seems that in addition to ecological resilience and capacity for biodiversity, child safety and the potential for place attachment are important factors to consider. Although from observation of the greenspaces in this study it is fairly clear that more space is needed (as demonstrated by figure 41 & 42). This is particularly important in cities where we continue to see a trend for urban

densification, despite recognition of the importance of HNC for human health and wellbeing (Barthel et al., 2010; Giusti & Samuelsson, 2020). As such the size of urban greenspaces is an interesting area for further research.

In the next section, I will discuss how the configuration of different physical elements have the potential increase the likelihood of SNS.

6.1.3 UTILISATION OF THE SNS CATEGORISATION IN THE DESIGN AND PLANNING PROCESS

By working with synergies between physical properties and different types of SNS, the design of pedagogical greenspaces could be enhanced. The results suggest that there are five complementary categories of SNS: restorative experiences, creative experiences, sensory experiences, physical free play and nature school which are each linked to specific physical properties.

The relation between the physical properties of these categories can be synergistic or distinctly different. For example, both creative and restorative experiences are linked to secluded space while physical free play is linked to open space. Similarly, while physical free play may be enhanced by the presence of a ball or tree to climb, a creative or nature school activity may be enhanced by the presence of logs to sit on or paper and a clipboard.

The differentiation between the physical properties of each SNS category has important implications for space optimisation and urban planning, since it suggests greenspaces can be designed to nurture specific types of nature connection, based on the characteristics of the spaces available and the needs of the community. It can also inform the kinds of organic and artificial materials that are brought to or used in the space. For instance, if a new green space is being created in a neighbourhood which already has a traditional playground that affords physical free play activities (such as running, jumping and sliding), the new space could be designed to enhance creative or restorative experiences, thus complementing the existing physical free play provision.

Figure 43 illustrates one possible way physical properties could be grouped to enhance synergies between SNS and manage trade-offs within the design of a single area. In figure 44, the SNS categories are overlaid to illustrate which areas include properties deemed important for each SNS category. The category ‘Nature School’ encompasses the entire space, since from the data it appeared that the physical properties of ‘Nature School’ activities were the most likely to change based on the aims of the mentor or teacher involved and that environmental variety was an important factor. Thus, it is considered that ‘Nature School Activities’ may occur in any place within this map.

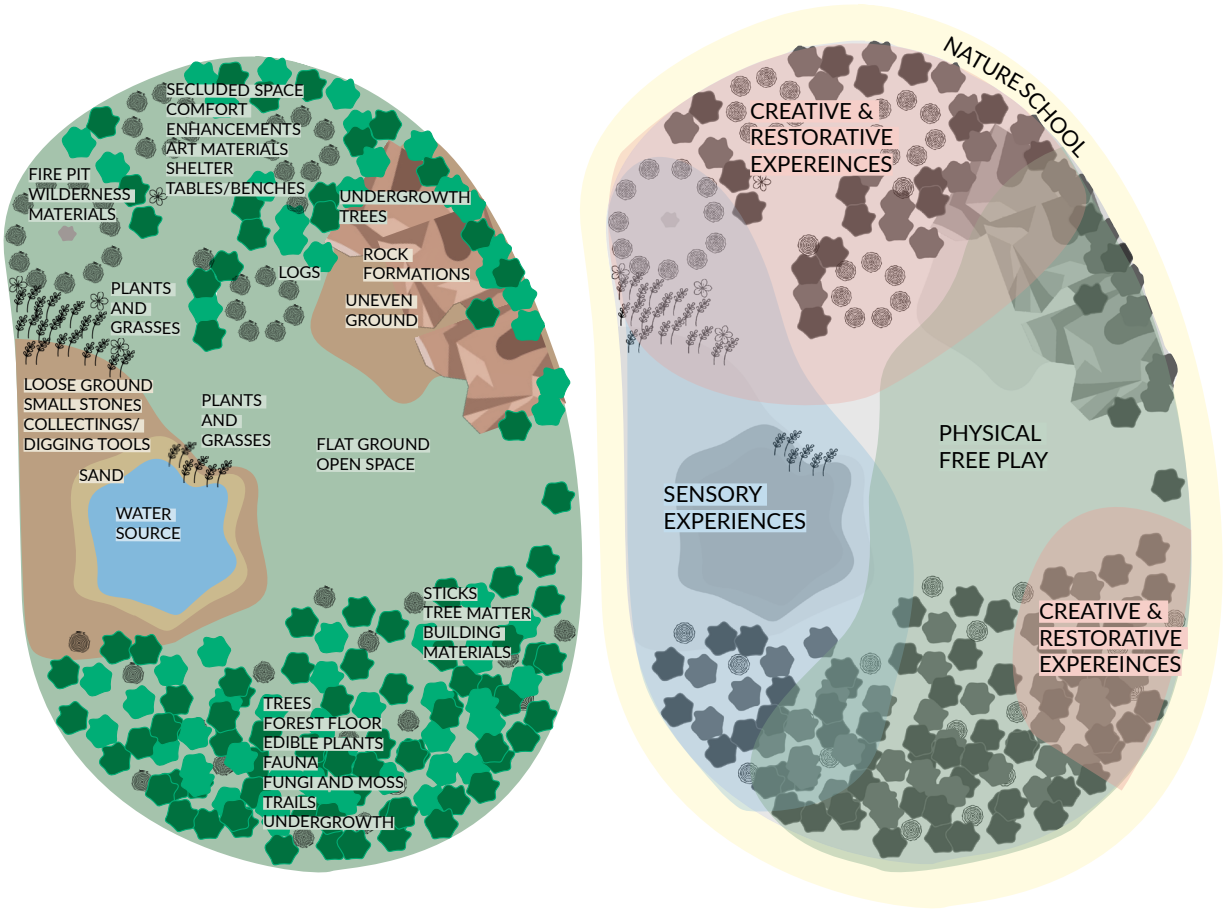

Fig. 43 & 44

Left: Example of pedagogical greenspace with physical properties grouped roughly by importance to different SNS.

Right: Example of pedagogical greenspace with SNS categories overlaid.

By designing urban greenspaces based on various kinds of SNS, there is potential to make them more appealing to children. Particularly since traditional playground design has been criticised for being too focused on functional forms of play and homogenous play structures (Frost, 2006). The potential to design greenspaces based on particular types of SNS gives children the agency to choose what kind of nature activity they want to engage in. This could to a small extent help address the limitations of children's independent mobility caused by the institutionalisation of child-friendly environments in urban areas today (Kyttä et al., 2018). Furthermore, by making urban greenspaces more desirable to children, it is possible to increase orientation towards spending time outdoors with numerous health and wellbeing benefits (Soga et al., 2015).

The results could also be used to assess the use of existing outdoor spaces. When deciding which nature area a school class should visit, teachers could consider the type of SNS they want to foster during the trip and select areas based on their suitability for that type of SNS. For example, if a teacher wants students to engage in sensory nature experiences, they could look for areas that have attributes that were frequently recorded in the 'sensory experiences' category such as loose-ground, edible plants, a water source or known animal/insect habitats.

According to Giusti et al., the different qualities of SNS influence different aspects of the development of nature connection and furthermore that human nature connection 'progresses over time through diverse nature routines' (2018, p.14). Planning a curriculum with trips to nature areas that are tailored to each of the five SNS macro categories could be a way of

ensuring children are exposed to diverse nature situations, thus enabling the dynamic progression of nature connection through time.

The results of this study offer guidelines about the potential of different physical properties to enhance children's HNC. However, it is important to note that the distinction between the five SNS macro categories does not suggest that certain nature situations only occur in relation to certain physical properties/landscapes, indeed in the observed schools, all five types of SNS occurred within the same spaces. However, it suggests that certain physical properties enhance the likelihood of certain nature situations taking place. For instance, a sandpit may enhance the likelihood of a sensory experience whereas a tree may enhance the likelihood of a physical one.

In the next section I will reflect on the combinations of materials and landscapes used in this study and how they enhance the potential for HNC in different ways.

6.1.4 COMBINATIONS OF MATERIALS AND LANDSCAPES

The three schools visited utilised differing combinations of natural and artificial materials in order to support and develop children's HNC. For example, in some instances children engaged in creative nature activities such as drawing, while sitting on benches at a picnic table and in others they worked directly on the ground. Similarly, in certain situations children utilised artificial play props such as toy cars or bricks and in others they played only with natural elements such as sticks and leaves.

The variety of approaches and materials used indicate that there is not a single way to design or utilise potential pedagogical greenspaces. It also suggests that high levels of artificial materials are not necessary for developing pedagogical greenspace that support HNC, since the children observed engaged in similar activities whether they had access to artificial materials or not. In fact, the less materials used to mediate the interaction between a child and their environment may even increase levels of HNC.

However, artificial materials and basic artificial structures may be useful for creating an 'entry point' for children who are not used to playing and learning outdoors. This is supported by the insight that children who have not spent time in outdoor education before, initially find natural environments difficult to engage with. In these instances, having items such as digging tools or play props available may provide a way for children to begin interacting with the environment around them. Thus, enabling them to develop the first HNC abilities, outlined by Giusti et al., of feeling comfortable in natural spaces and being able to see possibilities for action in natural spaces (2018).

The multiplicity of physical properties recorded also indicate that variety in the spatial configuration of pedagogical greenspaces is an important factor in the affordance of SNS. This supports findings that HNC is a complex ability which develops through diverse nature routines (Giusti et al., 2018) and that there is a 'strong relation between the structures of the landscape and the functions of play' (Fjørtoft, 2001, p. 117).

It is also important to note that not all significant nature situations take place in designed places. The data gathered for this study took place within the municipality of Stockholm where at least some element of the environment was designed to enable human access and use. Where access to large areas of healthy ecosystems exist, there is no need to design areas for specific SNS experiences, though knowledge of the different SNS groups may inform which area is most suitable to use. The application of this data is best suited to the design, planning and use of greenspaces within urban areas. However, it can also be utilised to identify and make use of existing greenspaces that are particularly important for various SNS.

In the next section I will consider how the promotion of child HNC and ecological resilience can be developed simultaneously through the design and use of urban greenspaces.

6.2 DESIGN FOR THE SOCIAL-ECOLOGICAL CITY

As stated in the previous section, in areas where children are able to routinely engage with diverse nature situations, there is arguably no need to design pedagogical greenspaces. However, in the urban context, nature has frequently been designed out of the everyday experience and in many respects urban design, through the prioritisation of compact living, can be seen to be partly responsible for the problem of human-nature disconnection (Samuelsson et al., 2018).

The concept of the social-ecological city offers one frame for reconceptualising the role of design as having the potential to enhance HNC, human health and ecosystem resilience within urban areas. By considering the need to 'support inhabitants' wellbeing, conserve local flora and fauna, and promote environmental education' within the same design intervention there is a potential to create radically different urban environments (Giusti & Samuelsson, 2020, p. 13).

The results of this study suggest that environments with multiple opportunities to develop children's connection to nature are also high in biodiversity. As stated in the previous section, properties that promote SNS are frequently reliant on combined levels of biodiversity and ecological connection (such as edible plants, fauna, moss and lichen). This mutually beneficial potential is termed by Giusti and Samuelsson as 'regenerative compatibility' (2020). In their study they found that within the urban landscape, the presence of a healthy ecosystem is more important for restorative experiences than the mere presence of nature (such as a homogenous grass lawn). This is evident in the results of this study which show that restorative experiences often occurred in areas with diverse physical features such as trees, rock formations, native grasses and secluded spaces.

It is important to note that greenspaces which go beyond the homogeneity of traditional parks and play areas, also require more systemic consideration in the design and use phase. Significant organic and landscape properties, such as trees, rocks, slopes, grasses, edible and non-edible plants, do not exist in isolation but are instead part of complex ecosystems. In order to increase biodiversity and thus potentially increase the number of SNS experienced

by children, it is important to understand how separate greenspaces interact within an urban area and how they are connected to wider ecosystems. Within the design phase, for instance, the presence of fauna and levels of biodiversity could be enhanced by creating nature corridors that allow species to move easily through a network of greenspaces.

To create networks of connected greenspaces within an urban area, a revision of the way certain areas of land are classified and protected in Sweden may be needed. For instance, in the case of the school whose neighbourhood is currently under development, the greenspace accessible to them has shrunk considerably because only a specific section was granted protection as a 'nature reserve'. This land now resembles a small green island within an increasingly dense neighbourhood. It is likely that this type of planning/development will have considerable impact on the resilience and biodiversity within this now fairly isolated reserve.

Within the use phase, biodiversity and the affordance of SNS could be enhanced by planting more fruit bushes and vegetables gardens in schoolyards. In addition to supporting sensory and nature school experiences, according to a study of allotment gardens in Stockholm, gardening activities are likely to 'contribute to the generation of ecosystem services and counteract ecological illiteracy' (Barthel et al., 2010, p. 263). While examples of these initiatives were recorded in the observed schools, they were rarely used. This may be partly because of seasonal factors or because they had not been fully integrated into the daily routines of the schools/preschools.

To conclude, the results show that environments that are high in biodiversity also present more opportunities for diverse SNS. This suggests that pedagogical greenspaces can have mutually beneficial outcomes for children and ecosystems. However, areas with such regenerative compatibility require new ways of conceptualising our relationship to nature and the prioritisation of ecosystems within the design of greenspaces and the planning of cities.

6.3 LIMITATIONS AND POSSIBILITIES FOR FUTURE RESEARCH

Research for the thesis was limited by three main factors: the number and nature of research methods, the number/diversity of case studies and time.

The validity of methods used in the case study component could be questioned on two levels. First, how can an outside observer identify a significant nature situation? And second, how can they understand which are the most important physical attributes related to that experience? In order to maintain scientific rigor while dealing with a subjective subject matter, every effort was made to ensure consistency in the way these situations were observed and recorded. Significant nature situations were understood in the broadest sense and any outdoor activity that involved natural components and which the child appeared engaged were included. Similarly, every effort was made to document all of the physical attributes visible during these interactions. In this way, I attempted to reduce bias in the way I selected and described significant nature situations.

The validity of the results could be improved by conducting a multi-method longitudinal research, this would enable a more sensitive understanding of the subject matter as well as observation of how seasonal changes influence the research participant's interaction with their environment.

Furthermore, one of the criticisms of traditional playground design is the lack of the child's perspective within the design process (Samborski, 2019). Conducting interviews with child research participants in addition to participatory observation, could improve the quality of the research and could reduce the risk of the researcher misinterpreting behaviour. It could also lead to a deeper understanding of the motivations behind interaction with certain materials and physical properties.

Possibilities for future research include:

1. Further spatial analysis of the design criteria for SNS.

The focus of this study was to understand which physical properties are important when designing pedagogical greenspace. However, an important aspect of design is the size of the area. Further research into the approximate amount of space needed for significant nature experiences in relation to the amount of children using the space is an important direction for future research.

2. A comparative study with schoolyards/parks which are not used in outdoor pedagogy.

The case study was based on observation of pedagogical greenspace with high potential for significant nature interactions (IUS schools). Further research into school yards and parks which do not use outdoor pedagogical approach could provide an interesting comparison for the results gathered in this study.

3. An action research project into co-designing a pedagogical greenspace based on the findings of this research.

The thesis focused on 'research into design', meaning the research was based on observation of a design phenomenon (Feast & Melles, 2010). In the future, it would be interesting to explore co-designing a pedagogical greenspace with children as a form of 'research through design', using the results gathered in this thesis as a guide.

4. Research into 'enabling factors' such as the presence of mentors and appropriate clothing.

Aside from the design and physical attributes of the spaces themselves, the presence of mentors and weather appropriate clothing appeared to be important factors in the actualisation of significant nature situations. The importance of these factors, raises questions of access since not all families can afford suitable clothing, have the opportunity to send their children to specific nature schools or the time to go out with them.

While issues of access were beyond the scope of the thesis, they represent an important area for further research particularly given existing levels of inequality in the provision of greenspace. Additionally, a comparative study into children's use of pedagogical greenspaces without the presence of a mentor would be useful in determining the role and importance of mentors in the affordance of SNS.

7 CONCLUSION

The purpose of this study was to critically examine how the design of pedagogical green spaces can enhance children's connection to nature. Through the literature review I considered the causes and effects of the current decline in children's experience of nature. Two main factors appear to be the increase in urban living and sedentary pastimes. Particularly the prioritisation of motorised transportation and space efficiency within urban planning, has limited urban children's ability to roam freely outdoors.

Literature on current practices in the design of urban children-friendly environments suggest a preoccupation with safety and ease of manufacture has led to the design of homogenous playgrounds. Such spaces typically afford possibility for functional play but lack possibilities for constructive or symbolic forms of play such as den making or role play. Alternative playground design, represented by the kindergarten and adventure playground movement, illustrate possibilities for child and nature centric design. These forms of design prioritise loose structures and parts that allow for open-ended child-led play and in the case of the kindergarten movement, the integration of nature in play spaces.

In recognition of the need to increase children's access to nature in cities today, the emerging playground naturalisation movement calls for the redesign of existing playgrounds with natural elements. The movement emphasises the importance of integrated nature experiences for children's development and enjoyment of playgrounds. This is supported by compelling evidence that natural environments afford more opportunities for independent play, longer and more complex play episodes and less competition over toys.

The results from this study show that pedagogical greenspaces are made up of diverse combinations of natural and artificial materials and features. However, while artificial materials such as tables and benches, craft material etc. may be useful for engaging children who are not used to playing in natural environments these did not appear to be necessary for the development of HNC and were not present in all of the observed spaces.

A main contribution of the study is the finding that there is a potential to design greenspaces to support specific types of nature situations. Furthermore, by working with synergies and differences between the combinations of physical properties recorded for each of the five SNS categories, there is potential to design a single space with areas reserved for different types of nature experience.

I observed two interconnected constraints in the design of pedagogical greenspaces, namely the size and biodiversity capacity of the spaces used. Many of the natural elements present in the observed nature situations relied on high levels of biodiversity. These elements were missing in the

areas routinely used by the children because they have been degraded by over-use. As a result, designers and planners should consider how many children and how much use an area of land and connecting ecosystems can support while still maintaining high levels of biodiversity and resilience.

In addition to the role of diverse natural elements in the affordance of SNS, I found that the decay of natural elements such as trees provided multiple opportunities for physical and sensory experiences as well as playing a key role in maintaining the health and resilience of the local ecosystem. Overall, an important implication of the study is the finding that many of the physical properties that enhance the likelihood of SNS, occur within healthy ecosystems and as such is a powerful motivator for development of urban greenspaces that simultaneously enhance ecosystem resilience with human health and wellbeing.

While urban design can be seen to be a major contributor to the problem of children's disconnection from nature, it also has the potential to reform this relationship through the prioritisation of diverse urban greenspaces. When faced with complex and interconnected problems such as biodiversity loss and the nature deficit, each design decision we make reveals something about what we believe to be sustainable based on our worldview. From a mechanistic perspective, the reduction of emissions through efficiency savings from urban densification may appear to be sustainable. However, the long-term impact of reduced daily connection with natural environments may have more far-reaching implications on our health, wellbeing and ability to relate to the world around us.

In order to create sustainable human habitats, I believe we need to transition from a mechanistic worldview, based on the separation of mind and matter, humans and nature, to an ecological worldview based on the regeneration of human-nature relations. The results of this thesis offer guidelines to urban planners and designers about how the design and use of new and existing pedagogical greenspaces could be enhanced to increase the potential for human nature connection based on regenerative compatibility between human and natural systems.

BIBLIOGRAPHY

Änggård, E. (2010). Making Use of “Nature” in an Outdoor Preschool: Classroom, Home and Fairyland. 23.

Azlina, W., & S., Z. A. (2012). A Pilot Study: The Impact of Outdoor Play Spaces on Kindergarten Children. Procedia - Social and Behavioral Sciences, 38, 275–283. https://doi.org/10.1016/j.sbspro.2012.03.349

Barthel, S., Folke, C., & Colding, J. (2010). Social–ecological memory in urban gardens—Retaining the capacity for management of ecosystem services. Global Environmental Change, 20(2), 255–265. https://doi.org/10.1016/j.gloenvcha.2010.01.001

Beery, T. H. (2013). Nordic in nature: Friluftsliv and environmental connectedness. Environmental Education Research, 19(1), 94–117. https://doi.org/10.1080/13504622.2012.688799

Bratman, G. N., Hamilton, J. P., & Daily, G. C. (2012). The impacts of nature experience on human cognitive function and mental health: Nature experience, cognitive function, and mental health. Annals of the New York Academy of Sciences, 1249(1), 118–136. https://doi.org/10.1111/j.1749-6632.2011.06400.x

Bruni, C. M., Winter, P. L., Schultz, P. W., Omoto, A. M., & Tabanico, J. J. (2017). Getting to know nature: Evaluating the effects of the Get to Know Program on children’s connectedness with nature. Environmental Education Research, 23(1), 43–62. https://doi.org/10.1080/13504622.2015.1074659

Brussoni, M., Ishikawa, T., Brunelle, S., & Herrington, S. (2017). Landscapes for play: Effects of an intervention to promote nature-based risky play in early childhood centres. Journal of Environmental Psychology, 54, 139–150. https://doi.org/10.1016/j.jenvp.2017.11.001

Capon, A. (2017). Harnessing urbanisation for human wellbeing and planetary health. The Lancet Planetary Health, 1(1), e6–e7. https://doi.org/10.1016/S2542-5196(17)30005-0

Carrus, G., Scopelliti, M., Lafortezza, R., Colangelo, G., Ferrini, F., Salbitano, F., Agrimi, M., Portoghesi, L., Semenzato, P., & Sanesi, G. (2015). Go greener, feel better? The positive effects of biodiversity on the well-being of individuals visiting urban and peri-urban green areas. Landscape and Urban Planning, 134, 221–228. https://doi.org/10.1016/j.landurbplan.2014.10.022

Ceschin, F., & Gaziulusoy, I. (2016). Evolution of design for sustainability: From product design to design for system innovations and transitions. Design Studies, 47, 118–163. https://doi.org/10.1016/j.destud.2016.09.002

Chemero, A. (2003). An Outline of a Theory of Affordances. Ecological Psychology, 15(2), 181–195.

Cole, R. J. (2012). Regenerative design and development: Current theory and practice. Building Research & Information, 40(1), 1–6. https://doi.org/10.1080/09613218.2012.617516

Cox, D. T. C., Hudson, H. L., Shanahan, D. F., Fuller, R. A., & Gaston, K. J. (2017). The rarity of direct experiences of nature in an urban population. Landscape and Urban Planning, 160, 79–84. https://doi.org/10.1016/j.landurbplan.2016.12.006

Czepkiewicz, M., Heinonen, J., & Ottelin, J. (2018). Why do urbanites travel more than do others? A review of associations between urban form and long-distance leisure travel. Environmental Research Letters, 13(7), 073001. https://doi.org/10.1088/1748-9326/aac9d2

Driessnack, M. (2009). Children and Nature-Deficit Disorder. Journal for Specialists in Pediatric Nursing, 14(1), 73–75. https://doi.org/10.1111/j.1744-6155.2009.00180.x

Feast, L., & Melles, G. (2010). Epistemological Positions in Design Research: A Brief Review of the Literature. 5.

Felzmann, H. (2009). Ethical Issues in School-Based Research. Research Ethics, 5(3), 104–109. https://doi.org/10.1177/174701610900500304

Fjørtoft, I. (2001). The Natural Environment as a Playground for Children: The Impact of Outdoor Play Activities in Pre-Primary School Children. Early Childhood Education Journal, 29(2), 9.

Folke, C., Biggs, R., Norström, A. V., Reyers, B., & Rockström, J. (2016). Social-ecological resilience and biosphere-based sustainability science. Ecology and Society, 21(3), art41. https://doi.org/10.5751/ES-08748-210341

Frost, J. L. (2006). THE DISSOLUTION OF CHILDREN'S OUTDOOR PLAY: CAUSES AND CONSEQUENCES. 26.

Gelter, H. (2000). Friluftsliv: The Scandinavian Philosophy of Outdoor Life. Canadian Journal of Environmental Education, 5, 77–90.

Giblett, R. (2012). NATURE IS ORDINARY TOO: Raymond Williams as the Founder of Ecocultural Studies. Cultural Studies, 26(6), 922–933. https://doi.org/10.1080/09502386.2012.707221

Gibson, J. J. (1979). The ecological approach to visual perception. Psychology Press.

Giusti, M. (2019). Human-nature relationships in context. Experiential, psychological, and contextual dimensions that shape children's desire to protect nature. PLOS ONE, 14(12), e0225951. https://doi.org/10.1371/journal.pone.0225951

Giusti, M., & Samuelsson, K. (2020). The regenerative compatibility: A synergy between healthy ecosystems, environmental attitudes, and restorative experiences. PLOS ONE, 15(1), e0227311. https://doi.org/10.1371/journal.pone.0227311

Giusti, M., Svane, U., Raymond, C. M., & Beery, T. H. (2018). A Framework to Assess Where and How Children Connect to Nature. Frontiers in Psychology, 8, 2283. https://doi.org/10.3389/fpsyg.2017.02283

Gray, C., Gibbons, R., Larouche, R., Sandseter, E., Bienenstock, A., Brussoni, M., Chabot, G., Herrington, S., Janssen, I., Pickett, W., Power, M., Stanger, N., Sampson, M., & Tremblay, M. (2015). What Is the Relationship between Outdoor Time and Physical Activity, Sedentary Behaviour, and Physical Fitness in Children? A Systematic Review. International Journal of Environmental Research and Public Health, 12(6), 6455–6474. https://doi.org/10.3390/ijerph120606455

Groenewegen, P. P., van den Berg, A. E., de Vries, S., & Verheij, R. A. (2006). Vitamin G: Effects of green space on health, well-being, and social safety. BMC Public Health, 6(1), 149. https://doi.org/10.1186/1471-2458-6-149

Harvey, D. (1996). Justice, nature, and the geography of difference. Blackwell Publishers.

Heft, H. (1988). AFFORDANCES OF CHILDREN'S ENVIRONMENTS: A FUNCTIONAL APPROACH TO ENVIRONMENTAL DESCRIPTION. 29–37.

Ives, C. D., Giusti, M., Fischer, J., Abson, D. J., Klaniecki, K., Dorninger, C., Laudan, J., Barthel, S., Abernethy, P., Martín-López, B., Raymond, C. M., Kendal, D., & von Wehrden, H. (2017). Human–nature connection: A multidisciplinary review. Current Opinion in Environmental Sustainability, 26–27, 106–113. https://doi.org/10.1016/j.cosust.2017.05.005

Kaczorowska, A. (2014). Ecosystem Services and Urban Resilience – Case of Stockholm. 9.

Kals, E., Schumacher, D., & Montada, L. (1999). Emotional Affinity toward Nature as a Motivational Basis to Protect Nature. Environment and Behavior, 31(2), 178–202. https://doi.org/10.1177/00139169921972056

Karsten, L. (2005). It all used to be better? Different generations on continuity and change in urban children's daily use of space. Children's Geographies, 3(3), 275–290. https://doi.org/10.1080/14733280500352912

Keniger, L., Gaston, K., Irvine, K., & Fuller, R. (2013). What are the Benefits of Interacting with Nature? International Journal of Environmental Research and Public Health, 10(3), 913–935. https://doi.org/10.3390/ijerph10030913

Kyttä, M. (2002). AFFORDANCES OF CHILDREN'S ENVIRONMENTS IN THE CONTEXT OF CITIES, SMALL TOWNS, SUBURBS AND RURAL VILLAGES IN FINLAND AND BELARUS. Journal of Environmental Psychology, 22(1–2), 109–123. https://doi.org/10.1006/jevp.2001.0249

Kyttä, M., Oliver, M., Ikeda, E., Ahmadi, E., Omiya, I., & Laatikainen, T. (2018). Children as urbanites: Mapping the affordances and behavior settings of urban environments for Finnish and Japanese children. Children's Geographies, 16(3), 319–332. https://doi.org/10.1080/14733285.2018.1453923

Luchs, A., & Fikus, M. (2013). A comparative study of active play on differently designed playgrounds. Journal of Adventure Education & Outdoor Learning, 13(3), 206–222. https://doi.org/10.1080/14729679.2013.778784

Mäkelä, V. (2019). Pedagogy and Human-Nature Connection. A case study of two pedagogical approaches and their relation to pupils' human-nature connection in northern Mato Grosso, Brazil. Stockholm Resilience Centre.

Masterson, V. A., Stedman, R. C., Enqvist, J., Tengö, M., Giusti, M., Wahl, D., & Svedin, U. (2017). The contribution of sense of place to social-ecological systems research: A review and research agenda. Ecology and Society, 22(1), art49. https://doi.org/10.5751/ES-08872-220149

Miller, J. R. (2005). Biodiversity conservation and the extinction of experience. Trends in Ecology & Evolution, 20(8), 430–434. https://doi.org/10.1016/j.tree.2005.05.013

Muelle, C. M. (2005). The History of Kindergarten: From Germany to the United States. 6.

Natural Learning Initiative. (2009). Creating and Retrofiting Play Environments: Best Practice Guidlines. NC State University.

Nicholson, S. (2009). The Theory of Loose Parts, An important principle for design methodology. Studies in Design Education Craft & Technology, 4.

Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The Nature Relatedness Scale: Linking Individuals' Connection With Nature to Environmental Concern and Behavior. Environment and Behavior, 41(5), 715–740. https://doi.org/10.1177/0013916508318748

Oloumi, S., Mahdavinejad, M., & Namvarrad, A. (2012). Evaluation of Outdoor Environment from the Viewpoint of Children. Procedia - Social and Behavioral Sciences, 35, 431–439. https://doi.org/10.1016/j.sbspro.2012.02.108

Palmer, C. (2001). Ethnography: A research method in practice. International Journal of Tourism Research, 3(4), 301–312. https://doi.org/10.1002/jtr.332

Pyle, R. M. (2011). The thunder tree: Lessons from an urban wildland. Oregon State University Press.

Raymond, C. M., Giusti, M., & Barthel, S. (2018). An embodied perspective on the co-production of cultural ecosystem services: Toward embodied ecosystems. Journal of Environmental Planning and Management, 61(5–6), 778–799. https://doi.org/10.1080/09640568.2017.1312300

Roberts, D. F., & Foehr, U. G. (2008). Trends in Media Use. The Future of Children, 18(1), 11–37. https://doi.org/10.1353/foc.0.0000

Samborski, S. (2019). Biodiverse or Barren School Grounds: Their Effects on Children. 50.

Samuelsson, K., Giusti, M., Peterson, G. D., Legeby, A., Brandt, S. A., & Barthel, S. (2018). Impact of environment on people's everyday experiences in Stockholm. Landscape and Urban Planning, 171, 7–17. https://doi.org/10.1016/j.landurbplan.2017.11.009

Shaw, A., Miller, K., & Wescott, G. (2013). Wildlife Gardening and Connectedness to Nature: Engaging the Unengaged. Environmental Values, 22(4), 483–502. https://doi.org/10.3197/096327113X13690717320748

Shier, H. (1984). Adventure Playgrounds, an Introduction. N.P.F.A.

Singer, D. G., Golinkoff, R. M., & Hirsh-Pasek, K. (Eds.). (2010). Play=learning: How play motivates and enhances children's cognitive and social-emotional growth (First issued as an Oxford Univ. Press paperback). Oxford University Press.

Soga, M., & Gaston, K. J. (2016). Extinction of experience: The loss of human-nature interactions. Frontiers in Ecology and the Environment, 14(2), 94–101. https://doi.org/10.1002/fee.1225

Soga, M., Yamaura, Y., Aikoh, T., Shoji, Y., Kubo, T., & Gaston, K. J. (2015). Reducing the extinction of experience: Association between urban form and recreational use of public greenspace. Landscape and Urban Planning, 143, 69–75. https://doi.org/10.1016/j.landurbplan.2015.06.003

Soulsbury, C. D., & White, P. C. L. (2015). Human–wildlife interactions in urban areas: A review of conflicts, benefits and opportunities. Wildlife Research, 42(7), 541. https://doi.org/10.1071/WR14229

Stanley, E. L. (2010). Monkey Brains and Monkey Bars: An ecological approach to the values of school recess, presented. Antioch University New England.

Susa, A. M., & Benedict, J. O. (1994). The Effects of Playground Design on Pretend Play and Divergent Thinking. Environment and Behavior, 26(4), 560–579.

Svane, U. (2017). Developing children's connection with nature: Exploring pedagogically designed nature routines in Swedish outdoor preschools. Stockholm Resilience Centre.

Sverige, & Naturvårdsverket. (2011). Right of public access—A unique opportunity. Naturvårdsverket.

Szczepanski, A. (2001). What is Outdoor Education? The Didactic Implications of Learning on the Context of Landscape. European Institute for Outdoor Adventure Education and Experiential Learning, 17–24.

United Nations, Department of Economic and Social Affairs, & Population Division. (2014). World urbanization prospects: The 2014 revision.

Williams, R. (1985). Keywords: A vocabulary of culture and society (Rev. ed). Oxford University Press.

Zylstra, M. J., Knight, A. T., Esler, K. J., & Le Grange, L. L. L. (2014). Connectedness as a Core Conservation Concern: An Interdisciplinary Review of Theory and a Call for Practice. Springer Science Reviews, 2(1–2), 119–143. https://doi.org/10.1007/s40362-014-0021-3

APPENDIX

APPENDIX 1: OBSERVATIONAL GUIDE USED TO DOCUMENT SNS DURING THE CASE STUDY

Observation Guide. School: Weather Date/time

Title:	Qualitie	1. Ent	2. Tho	3. Awe	4. Sur	5. Inti	6. Min	7. Self	8. Crea	9. Phy	10. Cha	11. sen	12.Child	13.Men	14. Strc	15. Soc	16.Ani
Abilities																	
1. Comfort		**Notes**															
2. Read ns																	
3. Act NS																	
4. Attach																	
5. Know																	
6. Curious																	
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Title:	Qualitie	1. Ent	2. Tho	3. Awe	4. Sur	5. Inti	6. Min	7. Self	8. Crea	9. Phy	10. Cha	11. sen	12.Child	13.Men	14. Strc	15. Soc	16.Ani
Abilities																	
1. Comfort		**Notes**															
2. Read ns																	
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Title:	Qualit	1. Ent	2. Tho	3. Awe	4. Sur	5. Inti	6. Min	7. Self	8. Crea	9. Phy	10. Ch	11. se	12.Chi	13.Me	14. St	15. So	16.Ani
Abilities																	
1. Comfort		**Notes**															
2. Read ns																	
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Title:	Quali	1. Ent	2. Tho	3. Aw	4. Sur	5. Inti	6. Min	7. Sel	8. Cre	9. Phy	10. C	11. se	12.Ch	13.Me	14. S	15. S	16.Ani
Abilities																	
1. Comfort		**Notes**															
2. Read ns																	
3. Act NS																	
4. Attach																	
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6. Curious																	
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APPENDIX 2: DESCRIPTIONS OF THE PHYSICAL PROPERTIES RECORDED

	Physical Properties	Description
Landscape	flat ground	A area in which the ground is relatively level
	uneven ground	A area with slopes or hills.
	loose ground	An area of soil covered land which has not be planted with grass.
	secluded space	'Secluded Space' is characterised as quiet or hidden areas, often out of sight or hearing range of supervising adults. Such spaces were typically found in forest environments where the forest floor, undergrowth, trees or rock formations could provide some form of privacy or shelter. Secluded spaces were also observed in playground environments where corners created by playground boundaries, shrubbery or the addition of gathered materials such as logs or planks created a sense of seclusion. Such spaces were often created by the children themselves and used by individuals or small groups of two or three.
	open space	A piece of land cleared of wood or bushes, usually used to describe a forest clearing or open school play area
	natural water sources	A body of water, in this case a lake or stream.
	forest floor	The ground beneath the trees in a forest, consisting of roots, soil and decomposing organic matter.
	trails	A small path forged through a forest or nature area.
	rock formations	A large rock outcrop or boulder.
Organic	fauna	Observed fauna include reptiles, mammals, insects, arachnids and gastropods
	trees	Tree species include pine and spruce, and broad leaf trees such as birch, oak, aspen, beech and various fruit trees
	logs	Parts of a tree that has fallen or been cut of. Various logs were available in the observed school yards. They were also used to make benches.
	small stones	Small stones or pebbles
	sticks	Branches that have been removed from their source. These came in various sizes from small enough to fit in a child's palm to large enough to build a child-size tipi
	edible plants	In the forest environment these include blueberries, lingonberries, stensöta (polypodium) and woodsorel. In the school yard vegetables growing in boxes were observed.
	non-edible plants	Non-edible plants include wildflowers, non-edible berry bushes, rosehip, bulrushes, nettles
	fungi and moss	Including mushrooms, lichen, spores and moss.
	undergrowth	A dense area of shrubs, bushes and other plants.
	rain water	Water that has fallen or been obtained as rain. This was often collected by the children from puddle or drainpipe
	native grasses	Long grasses/ meadowland that is (or appears to be) a natural component of the immediate area.
	tree matter	Tree matter is used to describe parts that have fallen/been picked from the trees. This includes leaves, bark, pine needs and cones etc.
Artificial	arts and crafts materials	Including paper, pencils, pens, yard, scissors, glue, paint, bushes, flat boards to lean on Etc.
	teaching materials	Including books, magnifying classes and gardening tools.
	wilderness materials	Items such as fire lighting equipment and carving knives.
	building materials	Loose planks, pallet board and tools to be used under supervision.
	sports equipment	The most common sports equipment was a ball although bandy sticks and a net were also used
	sand	Fine grain sand was found in sandpits and play structures within school yards. In this context it was considered to be an 'artificial' material as it was brought to the area and did not occur
	comfort enhancements	'Comfort enhancement' refers to moveable objects that increase the comfort of outdoor environments by providing warmth or shelter. Sit mats (small pieces of water and cold-proof foam padding that the child could sit on) were the most commonly recorded comfort enhancement though cushions, blankets or larger mats were also sometimes used.
	play props	such as play cars, people and bricks
	collecting/digging tool	such as buckets and spades
	shelter	Recorded forms of shelter associated with this category include: tipis, tarpaulin shelters and verandas (characterised as an undercover area beside a building created by an overhanging roof).
	fire pit	Fire pits were frequently found within school yards and nature areas. These usually took the form of a ring of stones surround by the ring of logs. In some instances a metal gauze was placed over the stones in the centre.
	waste disposal	including bin bags and compost bins
	play structures	such as climbing frames, balance ropes and sandpits
	table and/or benches.	The most common form of outdoor table and benches was a traditional picnic table with benches forming part of the structure.

APPENDIX 3: INFORMATION SHEET AND CONSENT FORM FOR SCHOOLS

Research Project: Being for Nature: Exploring the design of pedagogical greenspace to support connection to nature in the urban context.

Thank you for your interest in participating in this study which is a part of Abigail Garbett's masters thesis at Aalto University in collaboration with Dr. Matteo Giusti, postdoctoratal researcher at the Gävle University.

Purpose of the study: The overarching purpose of study is to explore how to better design pedagogical greenspace to support children's connection to nature in the urban context. More specifically, the study aims to understand how the physical properties of the greenspaces observed relate to the quality of children's interaction and connection to nature.

Description of study method and situation: The study will involve observing naturally occurring activities that take place outdoors, during the school day for the period of one week. No visual or audio documentation will be taken of the children, though photographs of the physical spaces when unpopulated may be taken to aid analysis. No personal data about the participants will be recorded. The study should not require extra time from teachers or interfere with daily activities of the students.

Possible risks and their prevention: Every effort will be made to ensure the safety, wellbeing and consent of the pupils. This will include providing the parents/ caretakers with information about the study and the possibility to deny their child's participation and providing the pupils themselves with information and the possibility to opt out via the teacher in charge. The researcher will approach the observation with sensitivity and respect for all participants and will consider non-verbal signs and cues from the participants which might indicate their enthusiasm or reluctance to be observed. Due to the unobtrusive nature of the study, the perceived risk is not greater than that which the participants may experience in daily life. In the case that the consent is not given by a pupil or parent/caretaker, observation of the particular child would be avoided and not used as data, but the child would still be part of the same activity as everyone else.

Insurance coverage: The study participants are covered by Aalto University-level insurances for accidents and damages during the study.

Measure to be taken in case of incidental findings: The study has not been designed to provide any clinical information. Nonetheless, in case the study happens to reveal a markedly non-typical unexpected finding, which the study subject is not aware of, a specialist doctor of the appropriate field will be consulted about this finding. Based on his/her estimation, the study subject may be recommended, if necessary, to seek appropriate further examinations.

Funding, compensation and use of data: The study is not funded and no compensation is offered to participants though participation will be important for obtaining data that will be used for scientific purpose, benefitting the field of environmental education and design. The data will be used for Abigail Garbetts master's thesis and potential academic publication after the thesis submission.

Participation and communication: The participation of your school is valuable, but completely voluntary, and you have the right to withdraw at any time during the study. If you have any questions now or anytime during the study, please contact Abigail Garbett (details on page 2). The research project is approved by Aalto University's Research Ethics Committee.

If you agree for your school to participate, please fill in the signature form on the next page.

Signature sheet

I have read and understood the study information sheet given to me and I have sufficient information on the process of the study.

I understand that my participation in the study is completely voluntary and that I have the right to discontinue my participation at any stage without any consequences. It has been explained to me that a designated researcher will, at my request, provide me with additional details of the general principles of the study and its progress or of the results concerning myself.

I have understood that the research data is gathered for scientific purposes only and it will not be given even in part to the study subject him/herself.

The research data and measurements related to the participants are only available to the researchers of the research group and they will not be presented to a third party without my written consent. The researcher in charge of the study may, however, give permission to his/her other cooperation partners to analyse the research data and results for scientific purposes or ask for a professional consultation on possible unexpected incidental findings without separate consent provided that the anonymity of the results has been ensured. Any type of commercial exploitation of the research data is prohibited.

The research data and measurements related to the participants may be used in Aalto University, without a new separate consent, to another study related to the same research area conducted by the same researcher.

I would like to receive the results of the study once it has been completed YES / NO

By my signature, I confirm my participation in this study.

Name	Date	Signature

Email

Name of researcher	Date	Signature

Master Student:

Abigail Garbett

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+46 793213155

Supervisors:

Prof. Eeva Berglund / eeva.berglund@aalto.fi

Dr. Matteo Giusti / matteo.giusti@hig.se

APPENDIX 4: INFORMATION SHEET FOR PARENTS / CARETAKERS OF THE PARTICIPANTS

Dear parent and/or guardian,

I, Abigail Garbett, masters student from Aalto University, under the supervision of Matteo Giusti, Postdoctoratal Research Fellow from the University of Gävle, are inviting your child to participate in the research project titled: Being for Nature: Exploring the design of pedagogical greenspace to support connection to nature in the urban context.

The overarching purpose of study is to explore how to better design pedagogical greenspace to support children's connection to nature in the urban context. More specifically, the study aims to understand how the physical properties of the greenspaces observed relate to the quality of children's interaction and connection to nature. Your child was selected because they are a student at a school with the required nature profile.

The study would involve observing naturally occurring activities that take place outdoors, during the school day for the period of one week. It should not interfere with daily activities of the students. No visual or audio documentation will be taken and no personal data about the pupils will be recorded. Every effort will be made to ensure the safety, wellbeing and consent of the pupils. This includes obtaining the consent of the pupils and providing them with information about the study via the teacher in charge. The researcher will approach the observations with sensitivity and respect for all participants and will consider non-verbal signs and cues from the participants which might indicate their enthusiasm or reluctance to be observed. Due to the unobtrusive nature of the study, the perceived risk is not greater than that which the participants may experience in daily life.

The study is not funded and no compensation is offered to participants though participation will be important for obtaining data that will be used for scientific purposes, benefitting the field of environmental education and design. The data will be used for Abigail Garbetts master's thesis and potential academic publication after the thesis submission.

Your consent, as well as your child's participation in the research is entirely voluntary, and they may withdraw at any time without penalty. You may also withdraw your consent at any time. Your refusal or withdrawal will not cause you any professional loss, either in relation to the researchers or the institution where your child is studying. In the case that the consent is not given (either by you or your child), observation of the child in question would be avoided and not used as data, but the child would still be part of the same activity as everyone else.

The study has not been designed to provide any clinical information. Nonetheless, in case the study happened to reveal a markedly non-typical unexpected finding, which the study participant is not aware of, a specialist doctor of the appropriate field will be consulted about this finding. Based on his/her estimation, the study subject may be recommended, if necessary, to seek appropriate further examinations.

All information obtained through the research will be confidential, ensuring the confidentiality of your child's participation in all stages of the study. The research project is approved by Aalto University's Research Ethics Committee and the principal of [name of school]. The study participants are covered by Aalto University-level insurances for accidents and damages during the study. If you have any doubts or questions during your participation in the research, you may contact me via telephone or email (details below).

If you do NOT want your child to participate, please fill in the signature form on the next page and return it to the school.

Many thanks, Abigail Garbett

abigail.garbett@aalto.fi

+46 793213155

Supervisors:

Prof. Eeva Berglund / eeva.berglund@aalto.fi

Dr. Matteo Giusti / matteo.giusti@hig.se

Signature sheet – to be fill out if you do not want you children to participate.

I have read and understood the study information sheet given to me and I have sufficient information on the process of the study.

I understand that my child's participation in the study is completely voluntary and that I have the right to discontinue their participation at any stage without any consequences. It has been explained to me that a designated researcher will, at my request, provide me with additional details of the general principles of the study and its progress or of the results concerning my child.

I have understood that the research data is gathered for scientific purposes only and it will not be given even in part to the study subject him/herself.

The research data and measurements related to the participants are only available to the researchers of the research group and they will not be presented to a third party without my written consent. The researcher in charge of the study may, however, give permission to his/her other cooperation partners to analyse the research data and results for scientific purposes or ask for a professional consultation on possible unexpected incidental findings without separate consent provided that the anonymity of the results has been ensured. Any type of commercial exploitation of the research data is prohibited.

The research data and measurements related to the participants may be used in Aalto University, without a new separate consent, to another study related to the same research area conducted by the same researcher.

By my signature, I confirm that I do not want my child to participate in this study. In this case, observation of your child will be avoided and not used as data, but the child will still be part of the same activity as everyone else

Name of parent	Date	Signature

Name of child	Email address of parent

Aalto-yliopisto

Päätös/Decision 1 (1)

25.09.2019

TUTKIMUSEETTINEN TOIMIKUNTA/RESEARCH ETHICS COMMITTEE
Puheenjohtajan päätös/Decision by the Chair

Tutkimuseettisen toimikunnan päätös / Research Ethics Committee´s decision: Kokous/Meeting 4/2019, 18.6.2019

2.3 § 2019_18_Garbet_ Being for Nature

Lausuntoluonnos - Draft statement: Reviewers 1. Juan José Valle-Delgado and 2. Wojciech Solowski:

This study intends to analyze how green spaces are used during school activities, with the aim of understanding how the design of urban greenspace could enhance children's ability to connect with nature. The study is based on qualitative notes from the observation of children behaviour. The data will be analyzed collectively and published anonymously. No personal data of the participant children will be collected. Visual or audio documentation of the children will not be recorded. The ethical risks are minimal and well considered. The only point to be clarified is if the collected data (to be used for a Master thesis at Aalto University) will be shared with the University of Gävle (one of the advisors works there). If that is the case, it should be stated in the information sheets.

Decision: To be approved after minor clarification. The Chair of AU ethics committee may accept the statement after verification

Muutokset / Revisions

Muutokset on tehty lausunnon mukaisesti. – The revisions have been made according to the statement.

Päätös / Decision

Muutos ja lausunto hyväksytään.
The revisions and the statement are accepted.

Puheenjohtaja
Chair

Ossi Naukkarinen

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